THE FORTISBC ENERGY UTILITIES

(comprised of FortisBC Energy Inc., FortisBC Energy (Vancouver Island) Inc. and FortisBC Energy (Whistler) Inc.)

2012-2013 Revenue Requirements and Rates Application

Volume 4

Attachments to the Response to BCUC Information Requests No. 1

June 30, 2011

Attachment 5.2

Scott A. Thomson
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February 16, 2010

British Columbia Utilities Commission
Sixth Floor
900 Howe Street
Vancouver, B.C. V6Z 2N3

Attention: Ms. Erica M. Hamilton, Commission Secretary

Dear Ms. Hamilton:

Re: Terasen Gas Inc.'s ("TGI") Role in Maintaining Olympic Legacy

We are writing to advise the Commission that TGI has entered into an arrangement with the Vancouver Organizing Committee for the 2010 Olympic and Paralympic Winter Games ("VANOC") that will allow the Company to be involved in maintaining the 2010 Olympic and Paralympic Games legacy in Vancouver. The opportunity, the details of which are described below, will ensure that the Olympic and Paralympic Cauldron will remain as after the Games have ended and the Olympic Flame has been extinguished. We consider this investment to be important for the Company and customers.

Background

The permanent Olympic and Paralympic Cauldron is located near the Vancouver Trade and Convention Centre, at the Jack Poole Plaza in downtown Vancouver. As you are no doubt aware from the TV images of Wayne Gretzky lighting the cauldron following the Opening Ceremonies, the cauldron is a significant monument. TGI's investment of $3 million funded the Olympic and Paralympic Cauldron.

The Company's agreement with the owner of Jack Poole Plaza (BC Pavilion Corporation) contemplates, in general terms, TGI retaining ownership of the Olympic and Paralympic Cauldron and having a license to permit the Cauldron to remain in Jack Poole Plaza for 20 years with renewal rights for an additional 40 years. The owner of Jack Poole Plaza will be responsible to maintain the Cauldron and keep it in good condition. Under its agreement with VANOC, the Olympic Flame will be permanently extinguished following the conclusion of the Olympic and Paralympic Games. A plaque commemorating the Games and TGI's participation will be part of the legacy.

As part of its Olympic commitment, Terasen obtained certain rights to purchase tickets for Olympic events. None of the tickets purchased were covered in revenue requirements or paid for by customers. All tickets acquired were purchased and paid for by employees with the exception of a block of tickets for the Opening and Closing Ceremonies which were funded by the shareholder.

Customer Benefit and Impact

Customers will benefit from the Company’s involvement in preserving the Olympic legacy. British Columbians have embraced the Olympics with the torch run attracting large, enthusiastic crowds in Vancouver and many other communities in British Columbia. The permanent cauldron, funded by Terasen Gas, has been a focal point of activity and celebration during the Olympics. TGI does business in the BC communities touched by the "Olympic spirit". We rely on good relationships with these communities to facilitate work on the utility infrastructure. Our investment in maintaining and enhancing these relationships assist us in completing projects on time and on budget, and ultimately in delivering energy service in an efficient and cost-effective manner.

We believe that TGI’s customers are getting good value from this investment in the Olympic legacy. The investment, which is included in 2009 rate base and will be amortized over 20 years, was funded through efficiencies realized in our PBR capital expenditure formula in 2009 and as such did not impact the opening rate base used for setting rates for 2010 and 2011 under the Negotiated Settlement Agreement (NSA) which will be unaffected by this investment. Ongoing operating and maintenance costs will be covered by the owner of Jack Poole Plaza. The rate impact of the investment beyond the NSA period is modest (approximately two-tenths of one cent per GJ in 2012 and declining thereafter).

Conclusion

TGI simply wished to advise the Commission that we had made this high profile investment. We believe that our investment in the Olympic legacy is important and in the interests of the Company and customers.

If you have any questions please feel free to contact me.

Sincerely,

TERASEN GAS INC.

Original signed:

Scott A. Thomson

Attachment 7.1

REFER TO LIVE SPREADSHEET

Provided in electronic format only

(accessible by opening the Attachments Tab in Adobe)

Attachment 11.1

REFER TO LIVE SPREADSHEET

Provided in electronic format only

(accessible by opening the Attachments Tab in Adobe)

Attachment 12.1

Chart of Accounts

Prepared by: Finance & Regulatory Affairs
Chart of Accounts

Revision Date: **June 2011**

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1. ASSETS

1.1 Current Assets

1.1.1 Cash and Temporary Investments

13100	Main Bank Account Cash held in commercial bank accounts (TD Canada Trust) available for general chequing purposes. The balance in this account will agree to the balance shown in the bank statement. Each day, SAP automatically clears the balances from accounts 13120, 13130, 13160, 13170, 13180, 13181, 13600 into this account.
13110	General Disbursement Clearing – Main Bank Clearing account – captures daily batches of outgoing EDI and cheque payments. Amounts are credited to this account from 13160 EDI Transfers & Wire Payments and 13112 CRS Clearing, and transferred daily to 13600 Inter-bank Transfer Clearing.
13111	Outstanding Cheques – Main Bank Outstanding cheques (issued but not yet cashed) relating to GL 13100. The account is credited as cheques are issued through accounts payable, and debited as cheques are cashed (entries from 13112 CRS Clearing Account). Cheques are held in this account until cashed or staledated (outstanding for 6 months or greater). Once cheques become staledated, a program is run that removes the cheques from the outstanding cheques list, and a journal entry is made to move the amounts into GL 25901 Unclaimed Cheques, for publication on the company's Unclaimed Property database.
13112	C.R.S. Clearing Account Clearing account for the CRS (Cheque Reconciliation Service) – a cashed cheque interface from the bank. Amounts are credited to this account from 13111 and then transferred daily to 13110 General Disbursement Clearing.
13120	Outstanding Deposits – Main Bank This account holds deposits in transit until properly recorded in the bank GL 13100. Deposits consist of daily deposits at the Surrey Ops Centre as well as the automated Energy deposits and daily credit card payments.
13130	Incoming Payments This account shall be debited when payments from customers and/or other sources are received, and credited as those amounts are transferred to the main bank account 13100.
13140	Returned Items Main Bank Captures daily returned and rejected items from the bank through GL 13600. Items are then offset to GL 13141 awaiting Energy processing back to customers' accounts.
13141	Unapplied Returned Items Individual returned items from bank such as NSF, credit card charges, and rejected deposit. Once customer accounts are adjusted in the Energy system, the items are then charged to account 14026 Energy – Returned Items Clearing.
13142	Returned Items – AP and Payroll Returns for accounts payable and payroll cheques.
13143	Credit Card Receipts Bank Account This account is debited when customers make payments with credit card. Currently only two major credit cards are accepted: VISA and MasterCard. Operates like 13140.

13150	CUC/CIS Clearing Account This account is used to capture incoming daily deposits from individual Energy CIS (Customer Information System) customers through the CUCBC (Credit Union Central BC) downloads.
13160	EDI Transfers & Wire Payments – Main Bank The EDI Transfers and wire payments are processed by Accounts Payable or Payroll to outside parties. The daily balance is cleared into the main bank account 13100 once matching entries are processed by Accounts Payable or Payroll.
13170	Preauthorized Payments – Main Bank This account includes payments from customers enrolled in the equal payment plan (EPP).
13180	Other – Main Bank This account includes miscellaneous debit and credit entries that are not matched to any bank account due to inconsistent and/or improper description. It also includes incoming funds from the sale of USD converted into CDN. If there are recurring items in this account, they will be monitored and set up to automatically clear by the system.
13181	Treasury Clearing This is a temporary Treasury account set up for the settlement of Commercial Papers and Short Term Investments. Amounts received or paid are coded to this account pending clearing to 13700 or 25001.
13190	Payroll Manual Cheques Bank Account This is a manual chequing account set up and monitored by the payroll department, to enable the issuance of manual payroll cheques on an as-needed basis.
13191	Outstanding Cheques – Payroll This account includes outstanding cheques relating to GL 13190.
13192	O/S Manual Pay Web Banking This is an open item clearing account for the Manual Payroll bank account (GL 13190) and will be used to manage the clearing of the Payroll Web banking entries. The account will assist in the clearing of the AP funding & the Web payments to ensure all Payroll payments are made.
13200	USD Bank Account Main account at TD Canada Trust to bank balance in US funds. Balance will agree to the bank statement balance in US dollars. Similar to 13100, daily balance equals amounts transferred from accounts 13211, 13220, 13260 and 13280 as these amounts clear the bank.
13211	Outstanding Cheques – USD Outstanding cheques (issued but not yet cashed) relating to GL 13200. The account is credited as cheques are issued through accounts payable, and debited as cheques are cashed (offset to 13200). Cheques are held in this account until cashed or staledated (outstanding for 6 months or greater). Once cheques become staledated, a program is run that removes the cheques from the outstanding cheques list, and a journal entry is made to move the amounts into GL 25904 Unclaimed Cheques, for publication on the company's Unclaimed Property database.
13220	Outstanding Deposits – USD This account holds deposits in transit until properly recorded in the bank GL 13200. The account is debited as cash is received and credited as amounts are deposited to the bank.

13260	EDI Transfer & Wire Payments – USD The US dollar EDI Transfers and wire payments are processed by Accounts Payable to outside parties. The daily balance is cleared once matching entries are processed by the bank (GL 13200).
13280	Other – USD This account includes miscellaneous debit and credit entries that are not matched to the USD bank account due to inconsistent and/or improper description. It also includes the sale of US funds and the conversion to CDN. Amounts are cleared from this account once they have been researched.
13501	Lands Imprest Account This account is currently inactive; balance is being maintained at approximately $25,000. Lands department is responsible for the account and its use.
13600	Inter-Bank Transfer Clearing Account Grand totals from EDI Transfers 13160, Unapplied Returned Items 13141 and Credit Card Receipts 13143 are collected into this account daily. If the systems have been processed correctly, these items will zero balance and will be cleared on the day following the daily system downloads.
13700	Temporary Cash Investments This account shall include the book value of temporary investments. Account is debited as funds are invested and credited as investments mature.
13840	CIBC Bank Account This account contains all manual and automated Banner payments, swaps/hedges/banker acceptances, and compressor lease costs for FEVI and FEW. Throughout the month, Treasury transfers funds out of this account to FEVI's TD CDN funds account G/L 13100 (FEVI's main commercial bank account).
13950	Accounts Payable Holdback Account Amounts withheld from vendors through Accounts Payable (usually 10%), to be release upon completion of work to inspection standards. Funds are held in a separate bank account until released (see also GL 25162).
13951	Holdback – Outstanding Cheques Outstanding cheques relating to 13950.
13952	Holdback – Outstanding Deposits Outstanding deposits relating to 13950.

1.1.2 Accounts Receivable

14001	A/R – Customers Core & Industrial Amounts due and collectible for sales of gas from Core and Industrial customers. Entries are posted by ABSU from the Energy system to record sales, refunds, returned cheques, bad debts, and cash received (see G/L 14012 for cash received process). Balance in the G/L will agree to the Energy system.
14003	A/R – Off System Sales Amounts due and collectible for sales of gas not required to meet current demand. Account is debited through journal entry based on reports generated from the Nucleus system, and cleared on the 25th of the month as wires are received from off system sales customers, posted through journal entry to clear the bank.

14004	A/R – Accrued Gas Revenue Unbilled revenue that has not been recorded by the Energy system for gas sales during any calendar month, due to customers not having their meters read, or not having a bill prepared prior to the end of the month. Customer bills and meter reading is based on a 22 cycle system. Unbilled revenue is accrued each month through journal entry, and reversed in the following month.
14012	Unapplied CIS Cash Receipts This account is a temporary clearing account for incoming cash from Energy residential customers. Normally as we receive payments from customers, A/R 14001 is credited and cash is debited. However, the Energy process has been to place incoming funds into a holding account 14012 and then using Energy reports to apply to A/R accounts in the four divisions (Lower Mainland, Fort Nelson, etc.) When customer payments are collected, the following entries are generated on Work Day 5: DR 131xx Bank CR 14012 Holding account Account Reconciliation can only be done after WD 5 once Energy group applies the cash. When there are rejects, the entries will be: CR 131xx Bank DR 14012 Holding account The process is done through the Automated Payment Exchange System (APES). The residual debit amounts represent the amounts returned and rejected deposits from the APES. Energy will then investigate which customer accounts should be reversed and produce a daily statement to show rejected items. Timing difference is usually caused by the time taken for the investigation. The rejected items are then cleared to G/L 14026 Energy – Returned Items Clearing.
14014	A/R – Other Amounts receivable for miscellaneous services, not billed through the Energy system. Amounts are billed through the SAP AR subsystem; the balance in this account will agree to the details in that subsystem.
14025	Energy – General Journal Clearing This account currently contains miscellaneous journal entries from Energy that need to be investigated and cleared to the correct G/L accounts and/or internal orders. Debits and credits to this account are generated from JV's done by ABSU at month end from the Monthly Gas Tariff Analysis Report or the Monthly Journal Batch Detail Report – General Journals. This account is to be used as a temporary holding account for items that need to be investigated where it is not clear where the amounts are supposed to reside.
14026	Energy – Returned Items Clearing This account includes rejected/returned payments from Energy handled customer accounts. The returned items come through different sources depending on the payment method (e.g. EFT, cheques, automated payments, etc.). They are cleared each month to the appropriate GL after investigation.
14027	Clearing – OF to Energy Billing This account contains billable jobs that have been completed per the Order Fulfilment (OF) subsystem. These jobs have been sent to the Energy system for billings, but have not yet been billed. Account is debited through entries from the OF system, and credited through journal entry posted by ABSU from the Energy system for transfers to Energy.

14028	A/R – ABSUI This account contains amounts receivable from Accenture Business Services for Utilities Inc. (ABSUI) pending invoicing through the A/R subsystem. Account is debited through internal orders for salaries, overhead and bank charges. As the amounts are invoiced into G/L 14014 (A/R-Other), this account is credited.
14029	A/R – Unbilled BC Hydro Transportation This account includes unbilled revenue for BC Hydro transportation on Vancouver Island. Amounts are accrued each month through journal entry and reversed the following month.
14030	A/R – Vancouver Island Joint Venture This account includes unbilled revenue for the 'Vancouver Island Joint Venture' which is comprised of seven mills. Amounts are accrued each month through journal entry and reversed the following month.
14050	Interest Receivable on Loans This account includes the interest receivable on short-term interest bearing investments (received at back end). Upon maturity of such investments, this account shall be cleared when the interest is received. Entries are through interface from the Treasury module of SAP.
14051	Financing Plan Receivable Amounts receivable from customers who are financing their gas payments in FEVI. Entries are from the Banner system.
14052	Customer Refund Clearing This account includes refunds owing to gas customers that are awaiting payment. The account is credited through journal entry from the Energy system, and debited as payments are made to customers through Accounts Payable.
14070	Energy Contra – EPP Smoothing This account represents amounts receivable or payable to Equal Payment Plan (EPP) customers based on the difference between the equal monthly amounts they have been billed through Energy and the actual gas consumed. Entries are from ABSU based on information in the Energy system.
14075	Miscellaneous Deposits Miscellaneous deposits paid by FortisBC and held by external parties. Account is debited as payments are made through Accounts Payable and credits as amounts are refunded to FortisBC. Deposits can be held for various time periods depending on the terms of the contract.
14076	Licence of Occupation Deposit Security deposits paid by FortisBC to Land & Water British Columbia Inc. The security deposits are for the right of way of our lines through creeks and rivers on Crown land. Account is debited as payments are made through Accounts Payable and credited as amounts are refunded to FortisBC.
14089	A/R – Unapplied Miscellaneous This account is a temporary clearing account for cash received in payment of miscellaneous accounts receivable (GL 14014) pending clearing to the correct GL account. Credits are via postings from the AR subsystem; debits are through AP as payments are transferred to the correct payee, or through journal voucher to clear.

14095	FICA Clearing When summary records are transferred from contract accounts receivable and payable to the general ledger, a document split may be required if not all the items in a G/L document could be posted in one document (due to the item limit of 999 in FI Documents). This G/L is used to balance each of the G/L document created. Posting to a transfer account will result in a zero balance once all the transfer documents have been posted.
14102	Employee Salary Advances Amounts advanced to employees through the payroll system. As amounts are advanced, this account is debited. When the employee reimburses the company (timeframe for repayment specific to each agreement), the cheque is credited to this account via journal entry.
14105	Employee Paid Absences Reimbursement Pension Meetings Amounts receivable from the FortisBC Gas Pension Plan for employee time spent attending pension meetings. The account is debited through the payroll system. When payroll submits an invoice requisition to bill the pension plan, an invoice is created in the AR subsystem (account 14014) and this account is credited.
14107	A/R – Gas Supply Hedges Amounts receivable for gas supply hedges from hedging counterparties. Amounts receivable are set up via journal entry based on reports from the Nucleus system. On the 25th of the month, wire transfers are received through the bank or paid through accounts payable to settle the hedge positions. The account can be in either a debit (receivable) or credit (payable) position.
14109	Employee Paid Absences Reimbursed Union Bus IBEW Amounts receivable from the IBEW for employee time spent on IBEW union business. The account is debited through the payroll system. When payroll submits an invoice requisition to bill the IBEW, an invoice is created in the AR subsystem (account 14014) and this account is credited.
14110	Employee Paid Absences Reimbursed Union Bus COPE Amounts receivable from the COPE for employee time spent on COPE union business. The account is debited through the payroll system. When payroll submits an invoice requisition to bill the COPE, an invoice is created in the AR subsystem (account 14014) and this account is credited.
14190-14196	FI/CO Reconciliation Accounts Used for FI/CO Reconciliation postings – restricted use.
14300	HST/GST Input Tax Credits Receivable Amount receivable for Harmonized Sales Tax/Goods and Services Tax Credits from the Federal Government. This account is used to code all HST/GST paid on suppliers' invoices through Accounts Payable or from the bank through wire transfers. At month-end, the balance of both this account and 25118 HST/GST Collected, is transferred to 25628 HST/GST Payable, and the net amount is either paid to or received from the Government.
14310	Residential Energy Credit (REC) Receivable Amount receivable for Residential Energy Credit from the Ministry of Finance. This account records the amount of REC receivable filed with the Ministry of Finance each month and will clear out upon receipt of the monthly credit.

14500	Allowance for Doubtful Accounts This is a contra account for GL 14001 AR Customers Core & Industrial and 14004 AR Accrued Gas Revenue. It contains the estimated allowance for bad debts relating to those two accounts. The allowance is based on an estimated percentage of receivables, based on experience. The balance is reduced as amounts are written off against the account from the Energy system, but adjusted back to the estimated percentage at each month end through journal entry to the bad debt expense accounts.
14800	WIP – Accounts Receivable This account shall contain costs incurred that are expected to be recovered from third parties. The costs are accumulated in this account until the job is completed and they are ready for billing. The process is that a project owner asks for an order to be created that settles to this account, and costs are coded against this order as they are incurred (CR to settlement cost element; DR to 14800). Once the project is ready for billing, the project owner sends a request to the Misc. AR billing group, indicating the order number. Once the invoice is entered into the AR system, the order is credited, and the 14800 account is cleared (CR to 14800; DR to 14014). If amounts that are billed differ from amounts collected, the project owner is contacted and the difference is written off per his/her instructions.
14801	WIP – Intercompany A/R This account is used to keep track of actual costs vs. budgeted costs for continuing service contracts. Credits to this account are generated monthly from JV's to allocate 1/12th of each contract amount. Debits to this account are generated in two ways. The first is actual costs from time sheets that have gone through the various continuing service internal orders that are settled into G/L 14801 on WD3 and WD5. The second is from JV's that are done after settlement to allocate the continuing service overheads. The resulting balance indicates the difference between the actual costs processed to date and the amount budgeted to date. At year-end, the account is cleared to zero, either through adjusting the billings or through clearing to the income statement.

1.1.3 Inventory

15001	Inventory – General Materials Costs of materials purchased primarily for use in the utility business for construction, operation and maintenance purposes. It should include also the book cost of materials recovered in connection with construction, maintenance and the retirement or property, such materials being credited to construction, maintenance or accumulated depreciation provision, respectively. Materials and supplies issued are credited to this account and charged to the appropriate construction, operating expense, or other account on the basis of a unit price determined by the use of cumulative average, first-in first-out, or another method of inventory accounting as conforms with generally accepted accounting principles. Account balance will tie to the SAP Material Management sub ledger balance.
15088	Inventory – SubContractor Clearing Account Clearing account used track material issued to SubContractors. Account is debited through settlement of IO 502988 when materials are issued to SubContractor and SubContractor labour is incurred. Account is credited when goods are received back into inventory at new cost including labour.

15099	Inventory – Gas Regulators Offset to Capital This is a contra to account 15001 Inventory (sub ledger – ties to materials management system). Under a special agreement with the BCUC, the Company is allowed to capitalize gas regulators as soon as they are purchased and start depreciation and AFUDC treatment immediately. Consequently, every month a JV is prepared to debit capital and credit inventory to move the balance of the gas regulator into capital.
15201	Inventory – Gas in Storage Cost of gas purchased, stored and held for use in meeting future gas service requirements of customers. Gas is held at various storage locations operated by third parties. Each month, these parties confirm the gas into storage, the gas taken from storage and the ending balance of gas. Monthly transactions are through journal entries based on these storage statements. For company 2000, amounts debited to this account for gas placed in storage are credited to 62501 GCRA - Gas Moved to Inventory; amounts credited to this account for gas withdrawn from storage are debited to 62502 GCRA – Gas Moved From Inventory. For other companies, amounts are debited to this account as gas is purchased through Accounts Payable; amounts are credited through journal entry based on gas sales volume in the month at the weighted average cost of the gas available for sale. The account is trued up each month-end for any differences between the balance in the account and the calculated inventory balance.
15202	Inventory – Propane Cost of propane purchased, stored and held for use in meeting future propane service requirements of customers. Amounts are debited to this account as propane is purchased through Accounts Payable; amounts are credited through journal entry based on propane sales volume in the month at the weighted average cost of the propane available for sale. The account is trued up each month-end for any differences between the balance in the account and the calculated inventory balance.
15290	Inventory – Odorant Cost of odorant purchased and held for use in the gas distribution system. Amounts purchased settle to this account through internal order 694016. Ending balance is adjusted each month to reports received from gas measurement based on purchases and consumption of odorant inventory for zones 1-3, 4, and 5.
15300	Transmission Line Pack Gas For FEVI, cost of gas owned by the Company and used to maintain such line pressure as is required for the transmission of gas.

1.1.4 Prepaid Expenses and Other Current Assets

16001	Prepaid Insurance This account contains unamortized insurance payments. Account is debited as insurance payments are made in December. Account is credited as the annual payment is expensed on a straight-line basis over the December to November time frame.
16002	Prepaid Training Trust Fund Amounts that have been paid by FortisBC Energy Inc. to the Training Trust Fund but not yet utilized for training expenses. This account was originally set up (debited) as contributions were made to the trust fund in the years 1991, 1992 and 1993, for each of the IBEW, COPE and M&E plans. Each year, the prepaid balance is increased by FortisBC's proportionate share of interest on the contributions, and reduced as FortisBC's proportionate share of funds are spent on training.

16003	Prepaid Other Items This account contains amounts that have been paid out that relate to periods falling within the next twelve months (other than insurance 16001 and interest 16004). These payments are amortized on a straight-line basis over the period they are expected to benefit.
16004	Prepaid Interest This account contains interest on issued commercial paper that has been paid up front. Interest will be calculated and expensed by the Treasury module according to the rates and terms of the specific commercial paper.
16200	Other Current and Accrued Assets This account includes the book value of any other current and accrued assets, not classified elsewhere.

1.2 Investments in and Advances to Subs and Affiliates

1.2.1 Investment in Subsidiaries and Affiliates

12002	Investment in Inland Energy Corporation The carrying value of FortisBC Energy Inc.'s investment in shares of Inland Energy Corporation
12005	Investment in FortisBC Energy Inc. The carrying value of FortisBC HoldingsInc.'s investment in shares of FortisBC Energy Inc.
12006	Investment in FortisBC Huntingdon Inc. The carrying value of FortisBC Holdings Inc.'s investment in shares of FortisBC Huntingdon Inc.
12007	Investment in FortisBC Holdings Inc. The carrying value of FortisBC Energy Inc.'s investment in shares of FortisBC Holdings Inc.
12008	Investment in Inland Pacific Enterprises Ltd. The carrying value of FortisBC Holdings Inc.'s investment in shares of Inland Pacific Enterprises Ltd.
12009	Investment in IPPDA LLC The carrying value of FortisBC Holdings Inc.'s investment in shares of IPPDA LLC
12011	Investment in Inland Pacific Energy Services Ltd. The carrying value of FortisBC Holdings Inc.'s investment in shares of Inland Pacific Energy Services Ltd.
12013	Investment in Inland Pacific Energy Corp. The carrying value of FortisBC Holdings Inc.'s investment in shares of Inland Pacific Energy Corp.
12023	Investment in 0849218 BC ULC The carrying value of FortisBC Energy Inc.'s investment in shares of 31905 Yukon Inc.
12024	Investment in 3857042 Canada Inc. The carrying value of FortisBC Holdings Inc.'s investment in shares of 3857042 Canada Inc.
12025	Investment in 605555 BC Ltd. The carrying value of FortisBC Holdings Inc.'s investment in shares of 605555 BC Ltd.

12027	Investment in 0849217 BC ULC The carrying value of 31905 Yukon Inc.'s investment in shares of 31916 Yukon Inc.
12028	Investment in FortisBC Holdings Inc. The carrying value of FortisBC Holdings Inc.'s investment in shares of Terasen Gas Holdings Inc.
12032	Investment in FortisBC Energy (Vancouver Island) Inc. The carrying value of FortisBC Holdings Inc.'s investment in shares of FortisBC Energy (Vancouver Island) Inc.
12033	Investment in CustomerWorks LP The carrying value of FortisBC Holdings Inc.'s investment in shares of CustomerWorks LP.
12037	Investment in 630319 BC Ltd. The carrying value of FortisBC Holdings Inc.'s investment in shares of 630319 BC Ltd.
12051	Investment in Homeworks Services Inc. The carrying value of FortisBC Holdings Inc.'s 25% investment in preference shares of FortisBC Home works Services Inc.
12064	Investment in FortisBC Energy Services The carrying value of FortisBC HoldingsInc.'s investment in shares of FortisBC Alternative Energy Services
12076	Investment in FortisWest The carrying value of FortisBC Holdings Inc.'s investment in series C preferred shares of FortisWest.
12077	Investment in Dockside Green Energy LLP The carrying value of FortisBC Alternative Energy Services investment in shares of Dockside Green Energy LLP.
12078	Investment in FortisBC Gas (Whistler) The carrying value of FortisBC Holdings Inc.'s investment in shares of FortisBC Energy (Whistler).

1.2.2 Advances to Subsidiaries and Affiliates

14200	Advances – Uncleared Asset Transfer Asset transfers between companies in the FortisBC group that have not yet cleared.
14201	Advances –FortisBC International Inc. This account contains all amounts due from and payable to FortisBC International Inc., including advances, trade accounts and interest. Amounts are charged or credited to this account through various sources, such as journal entry, order settlement and accounts payable postings. Balances are cleared as invoices are generated in GL 14229.
14203	Advances – Inland Energy Corp. This account contains all amounts due from Inland Energy Corp., including advances, trade accounts and interest. Amounts are charged or credited to this account through various sources, such as journal entry, order settlement and accounts payable postings. Balances are cleared through wire transfers.

14205	Advances – FortisBC Huntingdon Inc. This account contains all amounts due from FortisBC Huntingdon Inc., including advances, trade accounts and interest. Amounts are charged or credited to this account through various sources, such as journal entry, order settlement and accounts payable postings. Balances are cleared through wire transfers.
14207	Advances – FortisBC Holdings Inc. This account contains all amounts due from FortisBC Holdings Inc. to FEI including advances, trade accounts and interest, but excluding management fees. Amounts are charged or credited to this account through various sources, such as journal entry, order settlement and accounts payable postings. Balances are cleared through wire transfers.
14208	Advances – Inland Pacific Enterprises Ltd. This account contains all amounts due from Inland Pacific Enterprises Ltd., including advances, trade accounts and interest. Amounts are charged or credited to this account through various sources, such as journal entry, order settlement and accounts payable postings. Balances are cleared as invoices are generated in GL 14229.
14209	Advances – FortisBC Holdings Inc. Other This account contains all amounts due from FortisBC Holdings Inc., including advances, trade accounts and interest. Amounts are charged or credited to this account through various sources, such as journal entry, order settlement and accounts payable postings. Balances are cleared through wire transfers.
14212	Advances – FortisBC Energy Inc. This account contains all amounts due from FortisBC Energy Inc., including advances, trade accounts and interest. Amounts are charged or credited to this account through various sources, such as journal entry, order settlement and accounts payable postings. Balances are cleared through wire transfers.
14215	Advances – IPPDA LLC This account contains all amounts due from IPPDA LLC, including advances, trade accounts and interest. Amounts are charged or credited to this account through various sources, such as journal entry, order settlement and accounts payable postings. Balances are cleared as invoices are generated in GL 14229.
14216	Advances – Inland Pacific Energy Corp. This account contains all amounts due from Inland Pacific Energy Corp., including advances, trade accounts and interest. Amounts are charged or credited to this account through various sources, such as journal entry, order settlement and accounts payable postings. Balances are cleared as invoices are generated in GL 14229.
14229	A/R – Inter Company Customers Amounts receivable from affiliated companies, billed through the SAP AR subsystem; the balance in this account will agree to the details in that subsystem.
14231	Advances – 605555 BC Ltd. This account contains all amounts due from 605555 BC Ltd., including advances, trade accounts and interest. Amounts are charged or credited to this account through various sources, such as journal entry, order settlement and accounts payable postings. Balances are cleared as amounts are invoiced in G/L 14229 – A/R-Inter-company Customers.
14232	Advances – 3857042 Canada Inc. This account contains all amounts due from 3857042 Canada Inc., including advances, trade accounts and interest. Amounts are charged or credited to this account through various sources, such as journal entry, order settlement and accounts payable postings. Balances are cleared as amounts are invoiced in G/L 14229 – A/R-Inter-company Customers.

14233	Advances – FortisBC Holdings Inc. This account contains all amounts due from FortisBC Gas Holdings Inc., including advances, trade accounts and interest. Amounts are charged or credited to this account through various sources, such as journal entry, order settlement and accounts payable postings. Balances are cleared as amounts are invoiced in G/L 14229 – A/R-Inter-company Customers.
14234	Advances – 0849218 BC ULC This account contains all amounts due from 0849218 BC ULC (formerly 31905 Yukon Inc.), including advances, trade accounts and interest. Amounts are charged or credited to this account through various sources, such as journal entry, order settlement and accounts payable postings. Balances are cleared as amounts are invoiced in G/L 14229 – A/R-Inter-company Customers.
14235	Advances – 0849217 BC ULC This account contains all amounts due from 0849217 BC ULC (formerly 31916 Yukon Inc.), including advances, trade accounts and interest. Amounts are charged or credited to this account through various sources, such as journal entry, order settlement and accounts payable postings. Balances are cleared as amounts are invoiced in G/L 14229 – A/R-Inter-company Customers.
14237	Advances – CustomerWorks LP This account contains all amounts due from CustomerWorks LP, including advances, trade accounts and interest. Amounts are charged or credited to this account through various sources, such as journal entry, order settlement and accounts payable postings. Balances are cleared as amounts are invoiced in G/L 14229 – A/R-Inter-company Customers.
14238	Advances – FortisBC Energy (Vancouver Island) Inc. This account contains all amounts due from FortisBC Energy (Vancouver Island) Inc., including advances, trade accounts and interest. Amounts are charged or credited to this account through various sources, such as journal entry, order settlement and accounts payable postings. Balances are cleared through wire transfers.
14254	Advances – FortisBC Energy (Whistler) Inc. This account contains all amounts due from FortisBC Energy (Whistler) Inc., including advances, trade accounts and interest. Amounts are charged or credited to this account through various sources, such as journal entry, order settlement and accounts payable postings. Balances are cleared through wire transfers.
14266	Advances – FortisBC Alternative Energy Services This account contains all amounts due from FortisBC Alternative Energy Services Inc., including advances, trade accounts and interest. Amounts are charged or credited to this account through various sources, such as journal entry, order settlement and accounts payable postings. Balances are cleared through wire transfers.
14267	Advances - Fortis Inc. Borrowings This account contains all amounts due from Fortis Inc., including advances, trade accounts and interest. Amounts are charged or credited to this account through various sources, such as journal entry, order settlement and accounts payable postings. Balances are cleared through wire transfers.
14268	Advances - Fortis Inc. - Other This account contains all amounts due from Fortis Inc., excluding advances, trade accounts and interest. Amounts are charged or credited to this account through various sources, such as journal entry, order settlement and accounts payable postings. Balances are cleared through wire transfers.

14269	Advances - Fortis BC This account contains all amounts due from Fortis BC, including advances, trade accounts and interest. Amounts are charged or credited to this account through various sources, such as journal entry, order settlement and accounts payable postings. Balances are cleared through wire transfers.
14270	Advances – BCGI Trust This account contains all amounts due from BCGI Trust, including advances, trade accounts and interest. Amounts are charged or credited to this account through various sources, such as journal entry, order settlement and accounts payable postings. Balances are cleared through wire transfers.

1.3 Deferred Charges

1.3.1 Deferrals

17001	Unamortized Long Term Debt Issue Costs This account includes the net debit balances arising from the discount or premium, commission and expenses of each issue of Long Term Debt. The account is credited and interest expense is charged to reduce the balance to zero over the term of the individual debt.
17002	Unamortized Debt Discount & Expense – Series 2 & 3 This account includes the net debit balances arising from the discount or premium, commission and expenses of FortisBC Inc's issue of Series 2 and Series 3 medium term notes. The account is credited and interest expense is charged to reduce the balance to zero over the term of the individual debt.
17210	Preliminary Survey and Investigation Costs (WIP) All expenditures for preliminary surveys, plans, investigations, etc., made for the purpose of determining the feasibility of projects for gas services, and with the costs associated with applications for certificates of public convenience and necessity, board hearings, the acquisition of options to purchase land or land rights to provide a future supply of natural gas, easements and similar items for use in contemplated projects, unless these costs are being tracked separately in another deferral account. If, as a result of the surveys, plant for gas services is acquired or constructed this account will be credited and the appropriate gas plant account charged. If the work is abandoned, the charge will be to Account No. 31901 (Other Income Deductions). The records supporting the entries to this account will be so kept that the company can furnish complete information at to the nature and purpose of the survey, plans or investigations, and the nature and respective amounts of the charges. *Note 1: Preliminary engineering projects costing less than $10,000 are expensed to a general operations account.* *Note 2: A preliminary engineering project in excess of $10,000, for which no decision or result is obtained AFTER the allowable 12 months have expired, will revert as an expense to the cost centre which initiated the project. The cost centre must budget for this expense in the next available fiscal period, which is when the write-off will take place.*
17254	FortisBC Energy (Whistler) – Pipeline Study This account includes FEW costs for the pipeline to Whistler study. No additional costs to be incurred from 2001 onwards will be included here. These costs are not being amortized as they will become part of CPCN. Account receives AFUDC and net-of-tax treatment.

17263	FEW Pipeline Development Costs Deferral account set up to capture the pre-approval development costs relating to the FEW propane to natural gas conversion project and the FEVI pipeline project. These costs reflect activities by both FEW and FEVI to develop the project to the approval stage, including those costs related to the regulatory review and approval process of both the FEW and FEVI Applications. The deferral account was approved as part of the Whistler Pipeline CPCN under order C-3-06. This is a non-rate base deferral account attracting AFUDC until the pipeline goes into service in 2009, at which time it becomes a rate base deferral account. It will be amortized at 2.5% starting in 2010.
17510	Unamortized Conversion Expense FEI and Squamish expenses incurred while in the process of the original conversion of customers to a natural gas system. Included herein are all charges for labour and expenses of employees on converting the gas system and customers' appliances and includes all damage claims arising from such conversion.
17520	Accumulated Depreciation – Unamortized Conversion Expense The accumulated amortization of GL 17510. The amortized portion will be debited to Account No. 30402 (Amortization) over 50 years (Squamish) or 100 years (FEI).
17540	Propane to Natural Gas Customer Appliance Retrofit Conversion Costs (07-08) This account will contain the deferral costs for expenditures relating to the Appliance Retrofit Conversion costs plus the AFUDC charges per Commission Order G-53-06 and Decision dated May 18, 2006. The Decision per pages 49 and 50 sets out the basis that restricts the amount of costs that can be charged to this account. This account will be amortized over 20 years starting January 1 the year after the conversion is completed. This amount is net-of-taxed.
17541	Propane to Natural Gas Customer Appliance Retrofit Conversion Costs (2009) This account will contain the deferral costs for expenditures relating to the Appliance Retrofit Conversion costs plus the AFUDC charges per Commission Order G-53-06 and Decision dated May 18, 2006. The Decision per pages 49 and 50 sets out the basis that restricts the amount of costs that can be charged to this account. This account will be amortized over 20 years starting January 1 the year after the conversion is completed. This amount is not net-of-taxed.
17810	Organization Expense All fees paid to governments for the privilege of incorporation, other market development expenditures incident to organizing the corporation and putting it in readiness to do business and the related special counsel fees. *Note 1: All expense incurred in the issue of capital stock will be included in Account No. 177xx (Capital Stock Expense).* *Note 2: All discount and expenses incurred in the issue of long term debt will be* included in Account No.17001 (Unamortized Debt Discount and Expense).
17820	Accumulated Depreciation – Organization Expense This account records the accumulated depreciation relating to account 17810, which is being amortized to income G/L 30301 on a straight-line basis.
17904	Deferred interest on Debt In FEI, this account is used to keep track of the interest expense deferred due to the difference between the actual interest rate and the Company hurdle rate on long term and short term debt. The interest is deferred monthly and recovered over three years as approved by the BCUC order G-7-03. Account is maintained on a net-of-tax basis.

17907	Goodwill – CNG/FNG/SQ This account is used to record the unamortized goodwill resulting from the acquisition of Columbia Natural Gas (CNG) & Fort Nelson Natural Gas (FNG) and the amalgamation of Squamish (TGS). Since goodwill is no longer amortized as per the CICA Handbook, the amortization stopped as of 2004.
17912	SCP Net Mitigation Revenue This account is used to record any differences between actual net FEI revenues from SCP mitigation and what has been approved in the current revenue requirement, on a net-of-tax basis. Amounts are being amortized to income over 5 years under BCUC G-7-03.
17915	Property Tax Variance Deferral This account includes the differences between FEI actual and forecasted property taxes. The differences are recorded on a net-of-tax basis and amortized over a three year period under BCUC G-7-03.
17926	Midstream Costs Reconciliation Account – MCRA In company 2000, this account is a subdivision of the former Gas Cost Reconciliation Account (GCRA) and will reflect the difference between actual and forecast midstream gas costs as recovered in base rates allocable to all sales customers for whom FortisBC Energy acquires gas supply. Per BCUC order G-7-03, the MCRA account forecast is reviewed quarterly by the BCUC; if necessary, an adjustment will be made to the midstream cost recovery on customers' bills. Account is maintained net-of-tax and receives interest treatment.
17927	Revenue Stabilization Adjustment Mechanism – RSAM This deferral account will be used to mitigate the effect on the Company's earnings of unpredictable and uncontrollable factors, namely volume volatility caused primarily by weather and natural gas cost volatility as authorized by the BCUC Order G-07-03 and G-138-10 for FEI and FEW respectively. The RSAM will accumulate the margin impact of variations in the actual versus forecast volume use for residential and commercial customers. The offsetting accounts include: 32901 – RSAM for Fort Nelson Rates 1, 2.1, 2.2, and 25 32911 – RSAM for Lower Mainland, Inland, and Columbia areas as well as FEW Rate 1 32912 – RSAM for Lower Mainland, Inland, and Columbia areas as well as FEW Rate 2 32913 – RSAM for Lower Mainland, Inland, and Columbia areas as well as FEW Rate 3 32914 – RSAM for Lower Mainland, Inland, and Columbia areas Rate 23 Deferred RSAM costs are reviewed annually by the BCUC; and recovered from customers through Rider 5 on customers' bills. Account is maintained net-of-tax with interest deferral treatment to GL 17999.
17946	Pension Costs Variances For company 2000, this account will be used to record differences between actual pension costs (excluding OPEB) and the allowed pension cost based on the PBR filing. The account is maintained on a net-of-tax basis; amounts are amortized to income in the following year.
17947	Insurance Cost Variances For company 2000, this account will be used to record the difference between actual insurance costs vs. allowed insurance costs based from PBR filing. The account is maintained on a net-of-tax basis; amounts are amortized to income in the following year.

17973	Deferred Interest - MCRA This account holds the interest calculated on the difference between the actual and forecast average balance of MCRA times the composite interest rate as approved by the BCUC order # G-19-03. Account is maintained net-of-tax.
17977	Deferred NGV Grants For company 2000, this account includes new NGV Deferred Grants for 1998-2005 on a net-of-tax basis. Program developed as per I/O 500020 and approved by the BCUC orders # G-98-99 and G-07-03. Grants are being amortized over 5 years.
17981	Deferral – Other This account will include: a) the unamortized portion of unusual expenses not provided for elsewhere; b) the amount of debit balances in suspense accounts that cannot be cleared and disposed of until additional information is received; and c) the debit balances in clearing accounts not distributed at the end of the accounting period, deferred debit items not otherwise provided for and similar items the proper disposition of which is uncertain at the balance sheet date.
17982	Earnings Sharing Mechanism/Capital Incentive Mechanism For company 2000, this account includes the balance of the Earnings sharing mechanism which provides that customers will share equally in earnings variances (positive or negative) between allowed & actual earnings. Estimations are made monthly; actual amount is determined in annual report filing and refunded to/recovered from customers through rider 3 as approved by the BCUC order # G-07-03. Account is maintained on a net-of-tax basis. As well, it includes the capital off ramp incentive which is approved in the 2010/2011 NSP filing. This amount will be returned to customers over 2 years through Rider 3.
17991	Taxes on Post Employment Benefits In FEI, this account is used to record the tax on the difference between post employment benefits accrued according to GAAP and actual amounts paid. The deferral is calculated using the current tax rate. The deferral is not being amortized.
17993	OPEB Accounting – Initial Adoption In FEI, this account was used to capture the original expense relating to adopting the new accounting policy on OPEB in 2000 (accrue benefits as earned, rather than as they are paid). BCUC order # G-135-99. The deferral is not being amortized.
17999	Deferred Interest on RSAM This account will include the interest deferral of financing costs variances between forecasted and actual RSAM balances as per BCUC instructions from February 2003 for FEI and November 2010 for FEW. Deferral is on a net-of-tax basis; recovered as Rider 5 is recovered on RSAM account 17927. This FEI account will include the interest deferral of financing costs variances between forecasted and actual RSAM balances as per BCUC instructions from February 2003. Deferral is on a net-of-tax basis; recovered as Rider 5 is recovered on RSAM account 17927.
18003	Rider 2 ROE Revenue Requirement To set up additional revenues for the difference in rates between the approved April 1, 2009 delivery rates and the allowed July 1, 2009 delivery rates (based on the December 2009 ROE decision effective July 1, 2009). The rider will be charged to all customers (except bypass customers) for the 12 month period January to December, 2010 to recover these revenues.

18005	Residential Commodity Unbundling – O&M Costs This GL will be used to capture the ongoing operating and maintenance costs incurred in the running of the residential unbundling program. This account will begin to accumulate costs in 2007, once marketers are allowed to begin to enrol customers. This account will also contain the deferral for capital costs pertaining to the FEI Residential Unbundling -2008 Customer Education Costs per Commission Order C-6-06 from Aug 14, 2006 and accumulated in order 502101. The total amount to be charged to this GL is $3.0 million in 2008. This GL is a deferral account, with amounts recovered from eligible residential customers over a one year period starting in 2008.
18007	Alternative Energy Projects-O&M For Company 2000, this deferral account will recover the revenues & ongoing O&M related costs for investment in alternative energy solutions. The deferral account is a non-rate base account attracting AFUDC. The future treatment of the account will be applied for in the revenue requirement application for that year.
18008	Alternative Energy Projects-Capital For Company 2000, this deferral account will capture the capital-related costs for investment in alternative energy solutions. The deferral account is a non-rate base account attracting AFUDC. The future treatment of the account will be applied for in the revenue requirement application for that year.
18100	Goodwill – Victoria Assets This account includes the Goodwill on acquisition of Victoria assets from BC Hydro in 1989. The balance is not amortized as per CICA HB unless impairment exists (when fair value is less than carrying amount).
18109	PCEC Start-up Costs In company 6000, this account includes the start-up costs incurred prior to October 1, 1991 of $1,754,000 to be amortized at a rate of 2.5% per year. Pacific Coast Energy used to own the transmission portion of the business which was planned to be amortized over a period of 40 years starting in 1996.
18120	FEVI Pension & OPEB Variances This account includes deferred escalating costs on pension/OPEB for FEVI (actual vs. budget); amortized in the same year they are incurred. The balance in this account should be zero at year end (taken from O&M to amortization only).
18122	FEVI Insurance Costs Variances This account includes the deferred escalating costs on insurance for FEVI (actual vs. budget) which are amortized in the same year they are incurred. The balance in this account should be zero at year end (taken from O&M to amortization only).
18124	FEW Deferred Interest This account will be used to record the FEW dollar difference between the actual cost of short term debt and the long term debt rates that have been included in the application. File in revenue requirement to recover it. These costs will be amortized in the following 1-3 years.
18127	FEW Cost of Gas Deferral This account contains the difference between allowed and actual rate cost of gas for company 6100 on a net of tax basis. This account is to be reviewed quarterly. See G/L 18129 for recovery of gas.
18128	FEW Property Tax Variances For company 6100, this account will be used to record any variances between actual property taxes and property taxes in settlement document on a net of tax basis.

18129	FEW Cost of Gas Recovered This account includes the gas recovery of variance deferred in company 6100 G/L 18127. Costs are recovered through riders on customers' bills, posted through an interface from the Banner system. Recoveries are maintained on a net-of-tax basis.
18131	FEW Sales Margin Adjustment For company 6100, this account will include the deferral of the sales margin impact resulting from differences between normalized sales volumes, and those approved in rates, on a net of tax basis. Actual sales volumes are normalized to 'level' the temperature induced swings in energy sales. The offset of this account is G/L 32903 – Whistler Margin Adjustment. The balance is amortized to income in the following year.
18132	Deferral - Gas Cost Variance Account (GCVA) In company 6000, this account will include the deferred expenses resulting from differences between actual and budgeted gas cost on a royalty adjusted basis. The account serves to hold, and recover/refund the differences between the actual, and forecast cost of gas of the core market over a shorter time frame than if the variance flowed directly to the Rate Stabilization Deferral Account (RSDA) G/L 18201. The current year GCVA deficit/surplus is amortized into Cost of Service for the following year in the BCUC Annual Review process. The offset of this account is G/L 62326 – Gas Cost Variance Account (GCVA).
18137	Commodity Cost Reconciliation Account – CCRA This account is a subdivision of the former Gas Cost Reconciliation Account (GCRA) and will reflect the difference between actual and forecast commodity gas costs as recovered in base rates allocable to all residential customers and certain commercial customers for whom FortisBC Gas acquires gas supply. Per BCUC order G-7-03, the CCRA account forecast is reviewed quarterly by the BCUC; if necessary, an adjustment will be made to the commodity cost recovery on customers' bills. Account is maintained net-of-tax and receives interest treatment.
18139	Commercial Commodity Unbundling O&M Costs This account will contain the deferrals for operating and maintenance costs pertaining to the FEI Commercial Commodity Unbundling pursuant to the BCUC order number G-25-04. Costs are accumulated under internal order 501717 and maintained on a net-of-tax basis. Recoveries are through fees charged to the marketers (also coded to order 501717).
18146	Unbundling – Marketer Clearing This is a clearing account for company 2000 commercial unbundling marketer purchases and sales. It is debited each month with the marketer purchases; credited with the marketer sales; and the difference is transferred to the MCRA account as the marketer volume variance. The account should have a zero balance at month-end.
18148	OSC – Compliance Certification Costs This account is used to capture the costs related to OSC certification compliance M152-109 for 2004 & 2005 under BCUC G-112-04. Costs are captured under order 501776 and recorded on a net-of-tax basis. The deferral will be fully amortized by the end of 2005. FortisBC Energy Inc. (company 2000) will allocate 10% of the OSC costs to FEVI (company 6000).
18149	BCUC Assessments Post 2004 In company 2000, this account will include BCUC levies higher than budget to be deferred on a net-of-tax basis and amortized the following year as per Order G-112-04.
18154	Deferred gain/loss on swaps In company 1000, this account will include the deferral of gains or losses on swaps.

18159	Residential Unbundling Implementation (Capital) This account will be used to collect costs associated with the design and validation of the business model rules for the FEI Residential Unbundling Program. BCUC order numbers G-66-05 and G-110-05. The initial amount allowed under G-66-05 was $300,000, with an additional $1,053,800 under G-110-05 (total $1,353,800). Costs will be collected under internal order 501846, and recorded on a net of tax basis. As well, this account will contain costs accumulated under project Q-143 per Commission Order C-6-06 from Aug 14, 2006. The total amount to be charge to this GL is $11.1 million ($4.0 million in 2006 and $7.1 million in 2007). The project starts in September 2006 and ends in December 2007. This GL is a deferral account, with amounts recovered from eligible residential customers over a three year period starting in 2008. RUF Phase # 2 costs and Residual Customer Choice costs are also to be recorded here under order 502122 and 502123.
18160	Revenue Requirement Application The account includes the incremental cost related to creation of the new Revenue Requirement Application for all FortisBC Energy Companies. Amortization period will be determined as part of the Revenue Requirement decision.
18165	Energy Efficiency & Conservation Program In company 2000 & 6000, this rate base deferral account is used to record the EEC costs approved under BCUC Order G-36-09. These costs are recorded net-of-tax and amortized over 10 years.
18173	Deferred Interest - CCRA This account holds the interest calculated on the difference between the actual and forecast average balance of CCRA times the composite interest rate as approved by the BCUC order # G-19-03. Account is maintained net-of-tax.
18174	Biomethane Variance Account (BVA) This account is a rate base deferral account to capture the costs incurred to procure and process consumable Biomethane gas and the revenues collected through the Biomethane energy recovery component of rates. The account is similar to the other gas cost deferral accounts, and will reflect the difference between the actual and forecast biomethane supply and consumption volumes and dollars. Recovery rates will be reviewed quarterly by the BC Utilities Commission and will typically be reset on an annual basis. The account will be also used to record recovery from RS11B contract customers. The account is maintained net-of-tax.
18175	Biomethane Program – O&M Costs This non-rate base account attracts AFUDC and captures the program O&M costs. Beginning in 2012, the costs will be recovered through the delivery rate and amortized over a three year period. The account settles using I/O#503121.
18176	Biomethane Program – Cost of Services (Capital) This non-rate base account captures the capital related cost of services. Beginning in 2012, the costs will be recovered through the delivery rate and amortized over a three year period. The account does not attract AFUDC.
18200	2009 Revenue Surplus During 2009, FEVI's revenues were sufficient to fully recover the accumulated revenue deficiency (RDDA), and also to create a revenue surplus. The 2009 Revenue Surplus Account captures the revenue surplus that was created during 2009 for the difference between revenues collected less the cost of service less the 2008 ending balance of the RDDA. Of the balance in this non-rate base deferral account, $1.481 million will be returned to customers in each of 2010 and 2011. The remaining balance will be transferred to the Rate Stabilization Deferral Account.

18201	Rate Stabilization Deferral The Rate Stabilization Deferral Account is a non-rate base deferral account that captures: (a) differences in 2010 and 2011 between: i. the net revenues received; and ii. the actual cost of service, excluding O&M variances from forecast; and (b) any Accumulated Revenue Deficiency in the RDDA after December 31, 2009. Any balance in the RSDA, including accumulated interest, will be amortized into cost of service after 2011.
18504	SCP PST Reassessment Deferral Regulated deferral account to capture the $10 million payment made to the Provincial Government in relation to the proposed $36 million reassessment of PST on the SCP Project. FortisBC Energy is appealing the reassessment and when the appeal is resolved, FortisBC will seek a Commission order with respect to the disposition of the deferral account.
18507	Customer share of Lochburn land sale This account is used to capture the customer share of the gain on sale from the Lochburn property under BCUC G-116-07. Per the order "A refund of $2.5 million to ratepayers over one year by a rate rider to be filed with the first quarterly gas review following the date of completion of the sale is approved."
18509	IFRS Conversion Costs Rate base deferral account to capture the incremental costs of converting FortisBC from Canadian GAAP to International Financial Reporting Standards – primarily consulting, travel, training, SAP costs. Recovery will be determined at a future date.
18513	Carbon Tax Cost of Service Deferral Rate base deferral account used to capture the deferral of the carbon tax on own use fuel, as well as the resulting reduction in the Corporate Income Tax rate. This deferral will be amortized over three years beginning in 2009.
18514	Regulated Future Income Tax Deferral Non-rate base deferral account used to capture the deferral of the regulated future income tax amounts. The non-regulated amounts will be coded directly to the income statement through account 30602 – Future Income Tax Expense.
18515	Olympic Security Costs Deferral Rate base deferral account used to recover the critical security costs associated with the 2010 Olympic and Paralympic Winter Games, per order G-191-08. This deferral will be amortized over three years beginning in 2011.
18516	ROE Variance (2009) Regarding BCUC Order G-172-06, this account will be used to capture the ROE variance between the 2005 approved rate-setting ROE (9.75%) and the 2009 actual allowed ROE.
18517	Delivery Rate Refund Rider This account is used to capture the over collection of revenues for the period January 1, 2009 through March 31, 2009 associated with the misstatement of the January 1, 2009 Delivery Rate. Per BCUC Order No. G-XXX-09 "the forecast amount over collected from customers for the period January 1, 2009 through March 31, 2009, on account of the revenue deficiency overstatement, is refunded via a nine month Delivery Rate Refund Rider effective April 1,2009.

18518	2009 ROE & Capital Structure Costs This account is used to accumulate costs relating to the 2009 Return on Equity and Capital Structure application and hearing for Company 2000, 6000, and 6100. The account is maintained on a net-of-tax basis with amortization over five years beginning 2010.
18519	Capital Contribution to FEVI Pipe
18520	CCE CPCN Application costs This account is used to accumulate costs relating to the CCE CPCN application for FEI, FEVI and FEW. The account is maintained on a net-of-tax basis with amortization over five years beginning 2010.
18521	Tilbury Property Purchase-Capital This account is used to accumulate costs for the land related to the Tilbury Property Purchase. It is a non-rate base deferral account that accumulates AFUDC until the land is added to rate base and included in the year-to-year revenue requirements of FEI. FEI anticipates that the Tilbury Property Purchase incremental revenue requirement will not flow into rates until 2012, and that the deferred costs would be amortized over three years at that point.
18522	LILO tax reassessment Per the 2010/2011 revenue requirement application, this account is used to accumulate the full tax impact until the CRA ruling is reviewed. Due to the significant uncertainty around any potential tax liability, FortisBC Energy believes it is appropriate that a non-rate base deferral account attracting AFUDC be created, to record any resulting payments and associated legal costs, for disposition pursuant to a future direction from the Commission.
18523	Tilbury Property Purchase-O&M This account is used to accumulate costs for the remaining incremental O&M items related to the Tilbury Property Purchase. It is a non-rate base deferral account that accumulates AFUDC until the land is added to rate base and included in the year-to-year revenue requirements of FEI. FEI anticipates that the Tilbury Property Purchase incremental revenue requirement will not flow into rates until 2012, and that the deferred costs would be amortized over three years at that point.
18525	Income Tax Variances This account is used to accumulate any costs related to income tax variances from what was filed in the 2010/2011 NSP. It is a rate base deferral account and the amortization period will be three years.
18526	Gains and Losses on Asset Disposition IFRS requires that gains and losses on disposal of assets be recognized in the income statement. FortisBC Energy proposed to defer the amount of these gains and losses during the term of this Application for recovery in future years. This will have the same result as current practice, which is to record gains and losses in accumulated depreciation, and recover through future depreciation rates. The Company does not forecast gains or losses on asset disposals, however we requested Commission approval for any gains and losses incurred during 2010 and 2011 to be included in this rate base deferral account. The amortization period for these amounts will be determined in the next RRA.
18527	Deferred Removal Costs For 2010 & 2011, the provision for removal costs will be removed from depreciation estimates and included in the cost of service and recovered from customers. This new deferral account was created to capture any variances between the actual amount of net removal costs realized and the estimated amounts included in cost of service. Please refer to Appendix A, page 12 of the FEI Negotiated Settlement.

18528	IFRS Transitional Deferral A number of assumptions have been made in the preparation of this Application about final IFRS and their impacts on FortisBC Energy. The Company proposes a deferral account to capture: -Retained earnings adjustments required on transition to IFRS. -The 2011 impact of a one-time adjustment to pension expense under IFRS to recognize a market valuation allowance. -The one-time transfer of the existing gain balance from General Plant as part of the conversion in preparation for IFRS. -The impact of any difference between the depreciation rates or methodology recommended in the 2010/2011 NSP Application and the rates eventually required to comply with IFRS. -The impact of any difference between the overhead capitalization rate or methodology recommended in the 2010/2011 NSP Application and the rate or methodology required to comply with IFRS. -The rate impact of any other standard where the result of the particular IFRS is varied from what is assumed in the preparation of the 2010/2011 NSP Application. -This will be a rate base deferral with disposition of the actual balances to be determined at a future date.
18529	FEI 2010 Revenue Surplus Per the 2010/2011 NSP filing, a 2010 revenue surplus was established that must be moved to 2011. The 2010 entry will credit this account and debit account 32920 monthly and will be curved based on budget.
18530	IFRS Revenue Requirement Adjustment This non rate base deferral account is used to transfer the impacts of IFRS on the 2010 Revenue Requirements to 2011. For FEI, the impact of IFRS on the 2010 Revenue Requirements was a debit of $800,000, and this amount will be credited to 2010 income and charged against 2011 income. For FEVI, the impact of IFRS on the 2010 Revenue Requirements was a credit of $1,400,000, and this amount will be charged to 2010 income and credited against 2011 income.
18533	Interest on Gas in Storage This account holds the interest calculated on the difference between the actual and forecast average balance of Gas in Storage times the composite interest rate as approved by the 2010/2011 NSP. Account is maintained net-of-tax.
18534	2012 Revenue Requirement Application The account includes the incremental cost related to creation of the new Revenue Requirement Application for all FortisBC Companies. Amortization period will be determined as part of the Revenue Requirement decision.
18535	Decommissioning of Propane Assets BCUC Commission Order No. G-53-06 & G-35-09. The net book value of the Propane assets, including proceeds and disposal costs (other than Propane Land) is to be transferred to this deferral account. This account will also include the net book value of the IP Liquids line that is being retired along with the retirement costs. The transferred net book value is to be amortized over 20 years beginning in January, 2010. Income tax offset is not applicable to this deferral account as the net book value is not being expensed for income tax, but are already embedded in the respective CCA pool(s).
18536	Capital Gain on Sale of Propane Land BCUC Commission Orders G-53-06 & G-35-09. The after tax capital gain on the sale of the propane land is to be booked to this deferral account. The book of the propane is to be transferred to this deferral account, proceeds on disposal will be credited to this account and disposal costs including land remediation costs will be charged to this deferral account. The effective tax on the capital gain from the sale of the land will be charged to the deferral account; the account is to be amortized over 20 years beginning in 2010.

18537	Garbally Regional Office Replacement Project The project will complete a schematic and design development phase for a building and yard compound to support our Victoria Regional Office. The costs incurred for the this project will be consulting fees for Architectural, Structural, Mechanical, Electrical, Design and Industrial. This design completion will ensure the construction pricing for the application is accurate (90%).
18539	CCE Project O&M Costs This rate base deferral account will be used to capture any incremental costs related to the Customer Care Enhancement Project.
18540	Ft Nelson ROE and Capital Structure Deferral This rate base deferral is the result of the FNG 2010/2011 revenue requirement and is calculated on Attachment 2 of the RRA. It represents the difference in the 2009 approved ROE (8.47%) vs. the revised approved ROE (9.50%) multiplied by the approved equity of 35.01% * actual rate base of $5M. The balance in this account will be amortized in 2012.
18541	Tilbury Land Purchase Relating to account 18521-Tilbury Property Purchase and per BCUC Order G-68-10, this account will contain $3.3 million for the part of the land that FEI will be seeking to subdivide and sell. The account will be non rate base with interest. If FEI does sell the land, the proceeds will be credited against this account with any difference being returned to (or recovered from) customers over a yet to be determined period. If the land is not sold it by January 1, 2014, the balance will enter into rate base as land.
18542	2012 Rate Design Deferral The account will collect costs for extra resources – legal and consulting associated with the research, analysis and drafting of the 2012 Rate Design Application for postage stamp rates. The account includes costs for the regulatory proceeding such as evidence preparation for a possible oral hearing, BCUC billing and intervener billing. The deferral is rate based.
18543	NGV Fuelling Service Application Deferral A non-rate base deferral account attracting AFUDC to capture the NGV Fuelling Services costs incurred in 2010 and 2011 to recover those costs from all non-bypass customers by amortizing them through delivery rates commencing January 1, 2012 over a 3 year period.
18544	Deferred Removal Costs – Net of tax Please see description for a/c#18527 “Deferred Removal Costs”. This account was created to record net-of-tax entries for a/c#18527 as manual entries cannot be recorded in a/c#18527, which is mapped as a sub-ledger account in SAP.
18545	NGV Program Costs Deferral – Capital Cost of Service A non-rate base deferral account to capture the NGV Fuelling Services Program’s capital related Cost of Services. The account does not attract AFUDC and is not net of tax.
18546	Biomethane Application Costs Deferral A non-rate base deferral account attracting AFUDC to capture the Biomethane appcliation costs incurred in 2010 and 2011. The recovery of this account will be determined in the 2012/13 Revenue Requirement application.
18547	NGV Program Costs Deferral – O&M and Revenue A non-rate base deferral account to capture the NGV Fuelling Services Program’s O&M and Revenue. The account attracts AFUDC and is net of tax.
18548	US GAAP Conversion Costs Non-rate base deferral account to capture the incremental costs of converting FortisBC from Canadian GAAP to US GAAP – primarily consulting, travel, training, SAP costs. Recovery will be determined at a future date.

1.4 Other Long-Term Assets

1.4.1 Other Long Term Assets

12101	Long Term Investments – General The carrying value of the investments in securities issued by a non-related company; also investment advances made to such companies.
12300	Miscellaneous Special Funds This account is used to record the income tax timing differences associated with recording deferral accounts on a net-of-tax basis. The amounts in this account are used by the tax department to adjust taxes payable to a cash basis.
12501	Employee Mortgage and Housing Loans Amounts advanced to specific employees for home mortgages. Amounts are repaid (credited) to this account through payroll deduction until the loan has been repaid in full.
12502	Long Term Receivable (Huntingdon) Lease The capital lease receivable from FortisBC Huntingdon Inc. Balance is reduced as payments are received from Huntingdon; book value should agree to the book value of account 24901 in company 4000.
12506	Employee Loans Loans receivable from employees for financing of gas appliances. Amounts are repaid (credited) to this account through payroll deduction until the loan has been repaid in full.
12512	Loans Receivable Loans receivable from third parties. Account is debited as cash is advanced and credited as payments are received from the debtor.
12513	LILO Lease Payment Receivable Capital lease receivable from municipalities or cities that have elected to purchase the gas distribution assets within their franchise area. Lease receivable is created at the inception of the lease and charged each month with interest on the lease. Lease receivable is reduced as semi-annual payments are received from the municipalities or cities.
12515	Employee Share Purchase Loans This account records Fortis employee share purchase loans and the repayment through payroll deduction. The account is an open item managed by employee personnel number.

2. LIABILITIES

2.1 Current Liabilities

2.1.1 Short Term Debt

25001	Commercial Paper and Other Notes Payable This account will include the debt outstanding in the form of commercial paper and notes payable, due on demand or within a time frame not exceeding one year from date of issue. Account is credited as notes are issued and debited as they are repaid through postings from the Treasury module.
25002	Bank Loans This account will include bank loans payable, due on demand or within a time frame not exceeding one year from date of issue. Account is credited as bank loans are issued and debited as they are repaid, through journal entries from the bank statement.

2.1.2 Accounts Payable and Accrued Liabilities

25101	A/P – Trade Amounts payable by the Company to regular vendors for invoices entered into the AP system but not yet paid. The balance in this account will agree to the AP system.
25102	A/P – One Time Vendors Amounts payable by the Company to one-time vendors for invoices entered into the AP system but not yet paid. The balance in this account will agree to the AP system.
25103	A/P – Employee Amounts payable by the Company to employees for expense reimbursements and other miscellaneous amounts, where the expense claim has been entered into the AP system but not yet paid. The balance in this account will agree to the AP system.
25106	Biomethane Purchase Cost Liability For company 2000, actual biomethane purchases are created to this account based on information from the Entegrate deal capture system. Payments are made on the 25th of each month via wire transfer.
25111	Social Service Tax Payable All amounts payable by the Company to the Provincial Government for Social Services Tax (PST) collected from customers' gas and merchandise accounts and for tax self-assessed on purchases, but not yet remitted. Account is credited through ABSU's journal entry based on customer billings in Energy, and also through Accounts Payable postings for self-assessed PST. Account is debited as amounts are remitted to the government through Accounts Payable the following month.

25112	Miscellaneous Accruals This account will be used for standing accruals and as a temporary holding account for items that need to be accrued at month end/year end where payments will not be processed by Accounts Payable before the required deadlines. Debits and credits to this account are generated from JV's or payments processed by Accounts Payable. Guidelines for accruals are any items where the goods have been received or the service has been performed by the month end deadline, but the purchase order has not been processed in the purchasing system (25193 to 25198), and the invoice has not been entered into accounts payable (25101, 25102, 25103).
25114	Motor Fuel Tax Payable Amounts payable by the Company for Motor Fuel Taxes payable to the Provincial Government on natural gas consumed by the Company's compressor stations. The offset of this account is 64104 Facilities – Internal Charges in FEI and 30503 Motor Fuel Tax Expense in FEVI. Account is credited through journal entry based on compressor fuel consumption, and debited as amounts are remitted to the government through Accounts Payable the following month.
25115	Accrued Interest – Short Term Debt Interest accrued and payable on short-term debt (notes payable, commercial paper where interest is paid upon maturity, and bank loans) and on temporary investments where interest is received up front. Account is credited as interest is accrued at month-end and debited as interest is paid out, through postings from the Treasury module.
25117	Non Resident Withholding Tax Payable Tax withheld from service invoices where payment is to a country other than Canada. Postings are through the Accounts Payable system.
25118	HST/GST Collected This account will be credited with all the HST/GST collected from customers' gas accounts, merchandise accounts, and miscellaneous billings (i.e. after hours service calls, etc.). The balance on this account will be netted against account 14300 "HST/GST Input Tax Credits" in order to determinate the exact amount of the remittance (account 25628) or refund.
25119	Corporate Accruals Company-level accruals for items such as restructuring, incentives, LILOs, environmental, regulatory, and other items of a corporate nature. Accruals are through journal entry, payments are through Accounts Payable or Payroll.
25120	BC Hydro & PHH Vehicle Service Accrual This account will be credited when the monthly file is received from either BC Hydro (company 2000) or PH&H (company 6000) for the monthly lease and mileage charges for leased vehicles. The account is cleared as payments are made through Accounts Payable.
25125	Gas Purchase Cost Liability For companies 2000 and 3000, this account will include the estimated liability for the current month's gas purchases, based on information from Nucleus. This entry reverses in the following month. For all companies, actual gas purchases are credited to this account based on information from the Nucleus system. Payments are made on the 25th of each month via wire transfer initiated by the Accounts Payable department.
25126	Cost of Gas Accrual For companies 6000 and 6100, this account will include the estimated liability for the current month's Cost of Gas, System Gas Use, and Storage injection or withdrawal. The Cost of Gas estimate is then reversed in the following month when the actual gas purchase invoices are known (G/L 25125).

25127	Imbalance – Gas This account will include the difference between Westcoast Energy Pipeline metered and authorized deliveries and also the difference between transportation customers receipts and deliveries. Entries are through journal entry; the account will be adjusted monthly to reflect the most current balance available. The offset of this account is G/L 62413 – Imbalance Chg WEI & Transportation.
25131	IBEW Prior Year Timebank Liability Liability for time off earned but not yet paid to IBEW employees relating to prior years. The liability is drawn down throughout the year from postings from payroll as timebanks are used, and trued up to the calculated amount owing at the end of each year via journal entry prepared by the payroll department.
25132	Accrued WCB Accruals for Workers Compensation Board (WCB) payments. WCB is accrued as part of each payroll run based on rates configured in SAP payroll system (WCB'able earnings * rate). Each quarter, an assessment payment is made to the WCB – payroll receives remittance form and runs SAP report on WCB assessable earnings, enters this into a spreadsheet to calculate the remittance, and submits a payment requisition to Accounts Payable.
25133	COPE/M&E Prior Year Timebank Liability Liability for time off earned but not yet paid to COPE and M&E employees relating to prior years. The liability is drawn down throughout the year from postings from payroll as timebanks are used, and trued up to the calculated amount owing at the end of each year via journal entry prepared by the payroll department.
25134	COPE Dollar Bank Liability Liability for overtime banked but not yet taken as pay for COPE employees. Entries are through the payroll system.
25135	IBEW Dollar Bank Liability Liability for overtime banked but not yet taken as pay for IBEW employees. Entries are through the payroll system.
25137	ICE Levy Liability All amounts payable by the Company to the BC Government for the Ice Levy collected from customers' gas and for tax self-assessed on purchases, but not yet remitted. The account is credited in two ways: 1) through ABSU's journal entry based on customer billings in Energy, and 2) through Accounts Payable postings for self-assessed PST. Account is debited as amounts are remitted to the government through Accounts Payable the following month.
25138	Payroll Liability – Income Tax This account will include the income tax from employees' source deductions to be remitted by the Company to the CRA. Liability is created through entries from the payroll system; and reduced as amounts are transferred to GL 25166 for posting into Accounts Payable.
25139	Payroll Liability – Employment Insurance (EI) This account will include the Employment Insurance from employees' source deductions and the Company's expense to be remitted by the Company to the CRCA. Liability is created through entries from the payroll system; and reduced as amounts are transferred to GL 25166 for posting into Accounts Payable.
25140	Payroll Liability – Canada Pension Plan (CPP) This account will include the CPP from employees' source deductions and the Company's expense to be remitted by the Company to the CRA. Liability is created through entries from the payroll system; and reduced as amounts are transferred to GL 25166 for posting into Accounts Payable.

25141	Payroll Liability – Medical Service Plan (MSP) Accruals for Medical Service Plan (MSP) payments for COPE, IBEW and pensioners. MSP is accrued as part of each payroll run based on rates configured in SAP payroll system. Each month, payments are made through Accounts Payable based on reports generated from the payroll system. Balance should clear each month.
25142	Payroll liability – Dental Accruals for dental payments for COPE, IBEW and pensioners. Dental is accrued as part of each payroll run based on rates configured in SAP payroll system. In the following month, payments are made through Accounts Payable based on invoices received from Pacific Blue Cross. Differences between accruals and actual payments are expensed throughout the year.
25143	Payroll Liability – EHB Accruals for extended health benefits (EHB) payments for COPE, IBEW and pensioners. EHB is accrued as part of each payroll run based on rates configured in SAP payroll system. In the following month, payments are made through Accounts Payable based on invoices received from Pacific Blue Cross. Differences between accruals and actual payments are expensed throughout the year
25144	Payroll Liability – Disability Insurance Accruals for disability insurance payments for COPE and IBEW employees. Disability insurance is accrued as part of each payroll run based on rates configured in SAP payroll system. Payments to Manulife are made through Accounts Payable in three parts: a monthly deposit for administration of the plan is due in the current month; premiums relating to claims experience is due in the following month; management fee $100,000 for the year. Differences between accruals and actual payments are expensed throughout the year
25145	Payroll Liability – Accident Insurance Accruals for AD&D insurance payments for COPE and IBEW employees, and business travel accident (BTA) insurance for all employees. Insurance is accrued as part of each payroll run based on rates configured in SAP payroll system; payments are through Accounts Payable to W Sutton. Differences between accruals and actual payments are expensed throughout the year.
25146	Payroll Liability – Optional Life Insurance Accruals for optional life insurance payments for COPE and IBEW employees. Optional life insurance is deducted from employees' payroll as part of each payroll run based on rates configured in SAP payroll system. Payments to Manulife are made through Accounts Payable in two parts: a monthly deposit for administration of the plan is due in the current month and premiums relating to claims experience are due in the following month. Differences between accruals and actual payments are expensed throughout the year
25147	Payroll Liability – M&E Flex Benefits Accruals for the M&E Flex Benefits program for MSP, Health Spending Account (H.S.A.), Dental, Extended Health, Long-term disability, Group Life, Optional Life and AD&D). The M&E flex benefits liability is accrued as part of each payroll run based on rates configured in SAP payroll system. Payments are made through Accounts Payable as follows: MSP – payments to MSP are due in the current month H.S.A, Dental and Extended Health – payments to PBC are due in the following month LTD, Group Life, Optional Life – deposit paid in current month, premium paid in following month to Manulife. AD&D – deposit paid in current month, premium paid in following month to W Sutton Differences between accruals and actual payments are expensed throughout the year

25148	Payroll Liability – Group Insurance Accruals for group life insurance payments for COPE and IBEW employees. Insurance is accrued as part of each payroll run based on rates configured in SAP payroll system. Payments to Manulife are made through Accounts Payable in two parts: a monthly deposit for administration of the plan is due in the current month and premiums relating to claims experience are due in the following month. Differences between accruals and actual payments are expensed throughout the year.
25149	Union Defined Benefit Pension Liability Liability for the IBEW and COPE defined benefit pension plan. The estimated liability is calculated each month through the SAP payroll system based on employees' years of credited service and remuneration. The liability is reduced as amounts are transferred to GL 25166 for posting into Accounts Payable and remittance to the pension plan. Each quarter-end, the liability is trued up to actuarial estimates through a journal entry.
25150	Payroll Liability – RRSP This account will include the RRSP deductions from employees' pay to be remitted by the Company to London Life. Liability is created through entries from the payroll system; and reduced as amounts are transferred to GL 25166 for posting into Accounts Payable.
25151	Payroll Liability – Union Dues This account will include the union dues deducted from employees' pay to be remitted by the Company to the IBEW or COPE. Liability is created through entries from the payroll system; and reduced as amounts are transferred to GL 25166 for posting into Accounts Payable
25152	Payroll Liability - M&E Pension Plan Remittances Liability for the M&E pension plan. The estimated liability is calculated each month through the SAP payroll system based on employees' years of credited service and remuneration. The liability is reduced as amounts are transferred to GL 25166 for posting into Accounts Payable and remittance to the pension plan. Account will normally clear to zero each month.
25153	M&E Defined Benefit Pension Liability Liability for the M&E defined benefit basic and supplemental regulated pension plans. The estimated liability is calculated each month through the SAP payroll system based on employees' years of credited service and remuneration. The liability is reduced as amounts are transferred to GL 25166 for posting into Accounts Payable and remittance to the pension plan. Each quarter-end, the liability is trued up to actuarial estimates through a journal entry.
25154	Other Post Employment Benefits Accrual Accruals for Post Employment Benefits other than pensions, such as supplemental health, dental and life insurance coverage, to be paid to already retired employees and active employees upon retirement. The liability is determined based on actuarial estimates, and true up each quarter-end through a journal entry.
25155	Non-Regulated Pension Liability Liability for the M&E defined benefit supplemental non-regulated pension plan. The estimated liability is trued up to actuarial estimates through a journal entry each quarter-end.
25156	Payroll Liability – United Way This account will include employees' donations to the United way deducted at source to be remitted by the Company to the United Way. Liability is created through entries from the payroll system; and reduced as amounts are transferred to GL 25166 for posting into Accounts.

25157	Payroll Liability – Employee Share Purchase Plan (ESPP) This account will pool together the contributions made by employees for the purpose of shares purchases of common stock purchases of Fortis Inc. at a 10% discount to market. The balance of this account will be remitted on a regular basis by the Company to the Plan Administrator (Computershare) according to established procedures.
25158	Payroll Liability – Sundry Liability for payroll-related items, such as garnishees, not accrued under any other payroll liability account. Liability is created based on information from the payroll run, and reduced as payments are made through Accounts Payable.
25162	Construction Holdback Liability The Builder's Lien construction holdback as determined by the construction contract and purchase order terms and conditions. The holdback is 10% of the vendor invoice. Entries are through journal entry to record the holdback liability and the offsetting deposit to the holdback bank account; and to record the subsequent payment of the holdback once all the terms have been met and the offsetting cheque from the holdback bank account.
25164	Net Payroll Liability Liability for payroll due to employees, where the payroll has run but the payment has not yet been sent to the bank through wire transfer.
25165	Payroll Accruals Estimated liability for payroll due to employees, for the period of time between the last payroll run and the end of the month. Entry is calculated automatically from the payroll system, and reversed in the following month.
25166	Third Party Clearing for HRA Accounts Clearing account for payroll-related amounts to be remitted to CRA, pension plans, unions, etc. The system automatically posts the required payment to this account, and it is cleared when the amounts are cleared into accounts payable. Account normally has a zero balance at month-end.
25167	Pay Temp Net – No Bank Account Temporary holding account for pay liabilities, where banking information is missing or incomplete.
25168	IBEW Union & H&W Dues – Contractors Liability for union and health & welfare (H&W) dues payable to the IBEW for dependent contractors. Liability is created as payments to contractors are made through Accounts Payable, and reduced as amounts are remitted to the IBEW.
25171	Employee Savings Plan Liability This account is being used for the new employee savings plan starting in Jan 2007 and will be used in the creation of Payroll processing Journals.
25175	M&E Defined Benefit (2007) Pension Liability

25189	Payroll Liability – IBEW Flex Benefits Accruals for the IBEW Flex Benefits program for MSP, Health Spending Account (H.S.A.), Dental, Extended Health, Long-term disability, Group Life, Optional Life and AD&D). The COPE flex benefits liability is accrued as part of each payroll run based on rates configured in SAP payroll system. Payments are made through Accounts Payable as follows: MSP – payments to MSP are due in the current month H.S.A, Dental and Extended Health – payments to PBC are due in the following month LTD, Group Life, Optional Life – deposit paid in current month, premium paid in following month to Manulife. AD&D – deposit paid in current month, premium paid in following month to W Sutton Differences between accruals and actual payments are expensed throughout the year
25191	Payroll Liability – COPE Flex Benefits Accruals for the COPE Flex Benefits program for MSP, Health Spending Account (H.S.A.), Dental, Extended Health, Long-term disability, Group Life, Optional Life and AD&D). The COPE flex benefits liability is accrued as part of each payroll run based on rates configured in SAP payroll system. Payments are made through Accounts Payable as follows: MSP – payments to MSP are due in the current month H.S.A, Dental and Extended Health – payments to PBC are due in the following month LTD, Group Life, Optional Life – deposit paid in current month, premium paid in following month to Manulife. AD&D – deposit paid in current month, premium paid in following month to W Sutton Differences between accruals and actual payments are expensed throughout the year
25192	Large Customer Visa Clearing Clearing account for company VISA credit card purchases from trade vendors. As payment is made to Scotiabank VISA for the current month's purchases, this account is debited; as coding is received for the expenditure, this account is credited and the appropriate expense account is debited.
25193	GR/IR Meter Inventory Items Liability for meter inventory items where the goods have been received (GR) in the purchasing system, but the invoice has not been entered into Accounts Payable (IR). The account is credited based on entries from the purchasing system, and debited as amounts are transferred to Accounts Payable 25101. It is activated by a 101 movement in SAP. This movement activates the process that allows vendors to be paid for materials received.
25194	Credit Card Clearing Account Clearing account for company VISA credit card purchases by employees. As payment is made to Scotiabank VISA for the current month's purchases, this account is debited; as VISA statements with coding are received from employees, this account is credited and the appropriate expense account is debited.
25195	GR/IR IT Items Liability for IT (information technology) items where the goods have been received (GR) in the purchasing system, but the invoice has not been entered into Accounts Payable (IR). The account is credited based on entries from the purchasing system, and debited as amounts are transferred to Accounts Payable 25101. It is activated by a 101 movement in SAP. This movement activates the process that allows vendors to be paid for materials received.

25196	Vendor Managed Inventory / Consignment Contra Inventory This account will include the reconciliation amounts for vendor managed inventories. When goods are received into the warehouse, G/L 15001 – Inventory Account is debited and this account (25196) is credited (and vice versa). When the summary invoices come in, they are cleared to this account should all the prices stated balance. If they do not balance, then corrections are made on the goods' invoices to correct the pricing (these differences may arise due to unit of measure conversion issues for example).
25197	GR/IR Non Inventory Items Liability for non-inventory items where the goods have been received (GR) in the purchasing system, but the invoice has not been entered into Accounts Payable (IR). The account is credited based on entries from the purchasing system, and debited as amounts are transferred to Accounts Payable 25101. It is activated by a 101 movement in SAP. This movement activates the process that allows vendors to be paid for materials received.
25198	GR/IR Inventory Items Liability for inventory items (other than meters) where the goods have been received (GR) in the purchasing system, but the invoice has not been entered into Accounts Payable (IR). The account is credited based on entries from the purchasing system, and debited as amounts are transferred to Accounts Payable 25101. It is activated by a 101 movement in SAP. This movement activates the process that allows vendors to be paid for materials received.
25203	Payroll Liability – Benefits Deposits This account consists of payroll benefits premium deposits for COPE, M&E and IBEW employees for all companies (Co. 1000, 2000, 6000 and 6100).
25210	Employee Prepaid Benefits The account is used to facilitate reconciliation of prepaid benefit amounts. The process will require an employee going on leave to provide either a cheque or allocate an amount to be paid out from a time bank to be used to prepay all benefit/pension deductions due during the leave up to the last pay period ending date of that year. Since benefit amounts often change at year end, a new cheque will be required for the new year. The prepaid accounts should be reconciled each year end. Any remaining amounts should be refunded to the employee.
25211	Employee Prepaid Pensions The account is used to facilitate reconciliation of prepaid pension amounts. The process will require an employee going on leave to provide either a cheque or allocate an amount to be paid out from a time bank to be used to prepay all benefit/pension deductions due during the leave up to the last pay period ending date of that year. Since benefit amounts often change at year end, a new cheque will be required for the new year. The prepaid accounts should be reconciled each year end. Any remaining amounts should be refunded to the employee.
25301	Dividends Payable – Preferred This account will include the amounts payable as dividends to preferred shareholders as of the date of record.
25302	Dividends Payable – Common This account will include the amounts payable as dividends to common shareholders as of the date of record.
25303	Dividends Payable – 8.0% Capital Securities This account will include the amounts payable as dividends/interest to holders of FortisBC Inc.'s 8.0% Capital Securities as of the date of record. Dividends are accrued monthly through journal entry, and paid out by Accounts Payable,

25401	Customer Security Deposits Customer security deposits are collected from customers who have no history with FortisBC within the last two years, or have a poor credit history. Amounts collected are regulated by the BCUC. Customers earn interest on security deposits; they will be returned once certain conditions are met. Postings to this account through journal entries from ABSU based on information in the Energy system. The account balance will agree to listings of security deposits from the Energy system. The account will be credited when deposits are received and debited when refunds are issued.
25501	CIAC after 1997 Contributions in Aid of Construction (CIAC) received after 1997 are to be collected in this account. If the customer meets the requirements for refund under the MX contribution test, the amounts will be refunded. If the customer does not meet the requirements, after the designated number of years have passed, the contributions are transferred to GL 21101 "CIAC" as a credit to capital. Contributions are received through cash; and refunds are made through the Accounts Payable system.

2.1.3 Income and Other Taxes Payable

25601	Taxes Accrued – Income This account will be credited with the accruals of corporate income taxes which are payable to federal and provincial authorities. Each month, a journal entry is processed to accrue income tax payable based on current month's income or loss, less permanent differences, multiplied by the current income tax rate. Also each month, an instalment payment is made through Accounts Payable and debited to this account. At year-end, adjustments to the accruals may be made based on instructions from the tax department. When final tax calculations are made in June of the following year, adjustments are made to true-up the prior years accruals based on these filings. Any net balance owing or receivable is either paid through Accounts Payable or received via cheque from the CRA.
25610	Carbon Tax on Consumption All amounts payable by the Company to the Government for Carbon Tax collected from customers' gas and merchandise accounts and for tax self-assessed on purchases, but not yet remitted. The account is credited through ABSU's journal entry based on customer billings in Energy, and also through Accounts Payable postings for self-assessed carbon tax. Similarly, the account is debited as amounts are remitted to the government through Accounts Payable the following month.
25625	Taxes Accrued – Property This account will be credited with the accruals of property taxes which are payable to various municipalities, accrued on a straight-line basis as 1/12th of the annual budgeted amount. In June or July of each year, the annual property taxes are paid, and the liability is adjusted to account for any over or under accrual. In company 2000, any variance between actual and budgeted property taxes is deferred to G/L 17915.
25626	Taxes Accrued – Other This account will be credited with the accruals of any taxes not captured in another account (example would be Ontario taxes payable). Amounts are adjusted to actual once the payment is made.
25628	HST/GST Payable This account will be debited with HST/GST Input Tax Credits (ITCs) from account 14300 and credited with the HST/GST collected from customers (account 25118). The net result will determine the liability or the refund of HST/GST. Amounts are paid to (received from) the Receiver General in the following month.

25650	Taxes Accrued – Franchise Franchise fees are collected from customers located within municipal boundaries in the Inland and Columbia service areas. These fees are remitted by FortisBC Energy Inc. to the municipalities in either February or October of the following year. Fees are collected from customers through the Energy billing system on a calendar year basis; a JV is created which credits 25650 at 3.09% of revenues and debits 14001 (Customer AR). In the following year, ABSU prepares a payment requisition for each municipality. These payment requisitions are sent to the customer care manager at FortisBC for approval before being sent to accounts payable for payment. Upon being entered into the Accounts Payable system, 25650 is debited and AP is credited. Once all the payments have been made for the preceding year, variances should be investigated.

2.1.4 Interest Payable and Accrued

25701	Accrued Interest – Long Term Debt This account will include the amount of interest payable or accrued on long term liabilities, and on customer security deposits. Interest on long term debt is calculated each month and charged to Account No. 32000 (Interest on Long Term Debt) on a journal entry. Payments are through Accounts Payable according to scheduled interest payment dates.
25703	Swap Interest Receivable This account will include the amount of interest payable or receivable on interest rate swaps. Entries are through journal voucher each month.

2.1.5 Current Portion – Long Term Debt

25800	Current Portion – Long Term Debt The principal amount of long term debt which is due within the next year. Credits to this account are through journal entry to transfer amounts from long-term to current. As debt is redeemed through the Accounts Payable system (wire transfers), the account is debited.

2.1.6 Other Current and Accrued Liabilities

25900	Audit Fee Accrual This account will include the accrual for auditing fees. One twelfth of the estimated annual amount is accrued each month. Payments are made either quarterly or annually through Accounts Payable. Any differences between accruals and payments are adjusted at the time of payment.
25901	Unclaimed Property < $50 This account contains cheques outstanding issued to one time vendors, customers that closed their respective account(s) with a credit balance, and miscellaneous refunds not cashed. This account will be used where we have credits owed to customers/vendors but are unable to locate the customer to mail a cheque. We must keep the credit until either the customer/vendor requests payment of the amount or the appropriate time period has expired and then it may be reclassified as unclaimed property (as per the Unclaimed Property Act). This account will be debited when a cheque is reissued to an eligible customer/vendor, or when allowed by the UPA, qualified amounts can be transferred to Miscellaneous Income by the Company by way of a journal entry. On the other hand, the account will be credited as issued cheques become stale dated.

25902	Unclaimed Property > $50 & < $1000 This account contains cheques outstanding issued to one time vendors, customers that closed their respective account(s) with a credit balance, and miscellaneous refunds not cashed. This account will be used where we have credits owed to customers/vendors but are unable to locate the customer to mail a cheque. We must keep the credit until either the customer/vendor requests payment of the amount or the appropriate time period has expired and then it may be reclassified as unclaimed property (6 years as per the Unclaimed Property Act in 2010). This account will be debited when a cheque is reissued to an eligible customer/vendor, or when allowed by the UPA, qualified amounts can be transferred to Miscellaneous Income by the Company by way of a journal entry. On the other hand, the account will be credited as issued cheques become stale dated.
25903	Unclaimed Property > $1000 & < $25000 This account contains cheques outstanding issued to one time vendors, customers that closed their respective account(s) with a credit balance, and miscellaneous refunds not cashed. This account will be used where we have credits owed to customers/vendors but are unable to locate the customer to mail a cheque. We must keep the credit until either the customer/vendor requests payment of the amount or the appropriate time period has expired and then it may be reclassified as unclaimed property (10 years as per the Unclaimed Property Act in 2010). This account will be debited when a cheque is reissued to an eligible customer/vendor, or when allowed by the UPA, qualified amounts can be transferred to Miscellaneous Income by the Company by way of a journal entry. On the other hand, the account will be credited as issued cheques become stale dated.
25904	Unclaimed Credits This account currently contains credit balances transferred from Energy accounts and CUCBC Rejects/Suspense Debtor Items - Energy. This account will be used where we have credits owed to customers but are unable to locate the customer to mail them a cheque and must keep the credit until either the customer requests payment of the amount or the appropriate time period has expired and it may be claimed as unclaimed property. This account is debited when a journal entry is created in Energy to transfer credits back to an existing/active Energy account or credited when a journal entry is created in Energy to transfer credit balances to unclaimed credits so that an inactive account can be finalized. This account will also be debited by way of a journal entry when the appropriate time period has expired after the payment was originally received and the funds can be transferred to miscellaneous income per the Unclaimed Property Act.
25908	Unclaimed Property > $25000 This account contains cheques outstanding issued to one time vendors, customers that closed their respective account(s) with a credit balance, and miscellaneous refunds not cashed. This account will be used where we have credits owed to customers/vendors but are unable to locate the customer to mail a cheque. We must keep the credit until either the customer/vendor requests payment of the amount or the appropriate time period has expired and then it may be reclassified as unclaimed property (30 years as per the Unclaimed Property Act in 2010). This account will be debited when a cheque is reissued to an eligible customer/vendor, or when allowed by the UPA, qualified amounts can be transferred to Miscellaneous Income by the Company by way of a journal entry. On the other hand, the account will be credited as issued cheques become stale dated.
25910	Internal Audit Fee Payable This account will include the accrual for auditing fees. One twelfth of the estimated annual amount is accrued each month. Payments are made either quarterly or annually through Accounts Payable. Any differences between accruals and payments are adjusted at the time of payment.

25911	Customer Refunds To record refund liability to customers due to changes in sales rate. The credit balance will be gradually reduced when customers are charged at a lower rate from June 1 to December 31, 2009.

2.2 Long Term Liabilities

2.2.1 Long Term Debt

22000	Long-term Debt Total book value of outstanding debt, issued for a term of greater than one year. The amounts included will be further divided so as to show the amount of each class of long term debt, as follows: a) Mortgage Bonds - Bonds secured by lien on physical property. b) Debentures - Obligations secured under trust deed but not secured by a lien on physical property. c) Convertible Bonds - Bonds which may be converted into capital stock of the Company, according to the agreement under which they are issued. d) Long Term Notes Payable – Other notes payable. Each of the above classes will also be divided into sub-classes according to differences in mortgage or other lien or security thereof, rate of interest, interest dates, or date of maturity. The total of the amounts included in this account which are payable within one year from the date of the balance sheet will be reclassified to 25800 Current Maturities – Long-term Debt.
22002	Subordinated Debt This account will be used to record the principal of FEVI's subordinated debt to FortisBC Inc. as part of the acquisition agreement to convert Westcoast Energy Inc.'s Preferred Shares series A into debt. The interest on this debt was set at conversion and is subjected to reset. As a surplus is available, debt is drawn down based on whichever series is closest to coming due for reset at time of pay down. The offset to this account is G/L 32203 – Interest on Class B Subordinated Debt.
22005	Long Term Debt – Fortis Inc. Debt advanced to FortisBC Holdings Inc. by Fortis Inc. for a term greater than one year.
22006	Term Interco Debt – Fortis Inc. Debt advanced to FortisBC Holdings Inc. By Fortis Inc.
20100	8.0% Capital Securities The book value of FortisBC Holdings Inc.'s $125.0 million balance of 8.0% Capital Securities with a term to maturity of 40 years issued on April 19, 2000. The Company may elect to defer payments on these securities and settle such deferred payments in either cash or common shares, and has the option to settle principal at maturity through the issuance of common shares. Accordingly, the capital securities have been classified as equity. The securities are exchangeable at the option of the holder on or after April 19, 2010 for common shares of the Company at 90% of the market price, subject to the right of the Company to redeem the securities for cash. Distributions on these securities, net of related income taxes, are deducted from net earnings for the purposes of calculating earnings applicable to common shares.

24901	Capital Lease Obligation This account will contain the balances of the long term obligation arising from an arrangement for leasing property/equipment, which is in substance a purchase agreement with the lessee (FortisBC) being responsible for all expenses of ownership and the lessor providing financing for the purchase.

2.2.2 Other Long Term Liabilities

27102	Other Unearned Income This account will include any unearned income, not categorized elsewhere.
27103	Deferred Gains – LILO This account contains the unrecognized portion of the gain on sale and leaseback of pipeline assets to certain municipalities (currently Kelowna, Vernon, Prince George, Nelson and Creston). These gains are being amortized to income over the 17 year terms of the operating leases, commencing at the time of the sale transactions.
27601	Future Income Taxes This account will include the timing differences between income tax expense recorded for accounting purposes and income tax as reported on the tax returns. Currently, the regulated entities in the FortisBC group use the income taxes payable basis, and therefore do not calculate future income tax liabilities.
27902	Propane Cost Variances This account contains the deferred propane costs for the Revelstoke division and FortisBC Energy Services for Oliver's Landing. This is the difference between what Revelstoke/TES pays for propane vs. the reference price of propane. Amounts are recorded net of tax.
27905	ONA Scholarship Trust Fund Liability This account contains an opening balance of $92,100 which will be used to provide 5 scholarships (2 X $1500 + 3 X $500) annually to members of the Okanagan Nation. The balance will be invested into a one year term, annually. Interest entries are through journal voucher each year. For the payment of the scholarships, entries will be through Accounts Payable.
27907	MEMPR funds This account contains the funds remaining for the benefit of the MEMPR project. $5,155,000 was received from the Ministry of Energy, Mines and Petroleum (MEMPR) in support of LiveSmart BC's energy conservation and efficiency goals. In particular, these funds are focused on the Efficiency Incentive Program - Low-income Household Component. Allocation: $1.5 M to be spent in conjunction with BC Housing; $1.5 M with BC Hydro's low income program and the remaining $2.15 M will fund new low income programs. The program end date is March 31, 2012 or earlier if the funds are spent prior to this date.

3. SHAREHOLDER'S EQUITY

20001	Preferred Shares FortisBC Hodlings Inc.
20501	Common Shares – Par Value $.50/share This account will include the par value for all common shares issued and outstanding. The amount of consideration received from the sale of par value stock in excess of the amount credited to this account will be included in account 20502.
20502	Common Shares – Proceeds above $.50/share This account will include proceeds above the par value for all common shares issued and outstanding. The amount of consideration received up to the par value will be included in account 20501.
20504	Contribution from FortisBC Holdings Inc. Capital contributions from FortisBC Holdings Inc.
21001	Contributed Surplus Primarily related to contributed surplus resulting from Tax Loss Utilization Plans (TLUPs).
21002	Gain on Preferred Shares Purchase This account will contain the amount of consideration received from the repurchase of preferred shares in excess of the amount credited in preferred shares.
21103	Stock Compensation Liability This account tracks the stock compensation liability of FortisBC Holdings Inc. Amounts are expensed to G/L 60414.
21201	Retained Earnings General The balance in this account represents the corporation's unrestricted accumulated undistributed net income (or net loss).
21202	Retained Earnings – Prior Year Adj. Adjustments to retained earnings for items other than earnings. Adjustments would usually be for the retroactive restatement of prior year's income as a result of changes to Generally Accepted Accounting Principles, or corrections of prior year's errors.
35701	Dividends on Common Shares The amounts declared payable from retained earnings as dividends on outstanding common share capital issued by the Company.
35900	Adjustments to Retained Earnings This account will include significant non-recurring transactions relating to prior periods such as litigation settlements and related income taxes applicable to retained earnings adjustments. The records supporting the entries to this account will be kept so that the Company can furnish complete information as to the nature and amount of each transaction. All entries to this account must receive prior commission approval.

4. REVENUES AND COST OF GAS (MARGIN)

4.1 Residential Sales

52001	Rate 1 Residential Revenue from the sale of gas to residential customers (Rate 1) for the Lower Mainland, Inland, Columbia, Ft Nelson and Squamish service areas. Includes billed revenues from ABSU Energy system, and unbilled estimates.
52050	Residential Gas Sales (RGS) Revenue from the sale of gas to residential customers (Rate RGS) for the Vancouver Island service areas. Includes billed revenues from Banner billing system, and unbilled estimates.
52060	Residential Gas Sales (RGS) Revenue from the sale of gas to residential customers (Rate RGS) for the Whistler service areas. Includes billed revenues from Banner billing system, and unbilled estimates.
52081	Residential Propane Sales (SGS2) Revenue from the sale of propane to residential customers (Rate SGS2) for the Whistler service area. Includes billed revenues from Banner billing system, and unbilled estimates.
52090	Residential Propane Sales Revenue from the sale of propane to residential customers for the Inland (Revelstoke) and Squamish service areas. Includes billed revenues from ABSU Energy billing system, and unbilled estimates.
52091	Residential Geothermal Revenue from the sale of geothermal energy to residential customers. This account is for FortisBC Alternative Energy Services only.

4.2 Commercial Sales

52102	Rate 2 Small Commercial Revenue from the sale of gas to small commercial customers (Rate 2) for the Lower Mainland, Inland, Columbia, Ft Nelson and Squamish service areas. Includes billed revenues from ABSU Energy billing system, and unbilled estimates.
52103	Rate 3 Large Commercial Revenue from the sale of gas to large commercial customers (Rate 3) for the Lower Mainland, Inland and Columbia service areas. Includes billed revenues from ABSU Energy system, and unbilled estimates.
52104	Rate 4 Seasonal Revenue from the sale of gas to seasonal commercial customers in the Lower Mainland and Inland service areas. Includes billed revenues from ABSU Energy system, and unbilled estimates.
52150	Small Commercial 1 Gas Sales (SCS1) Revenue from the sale of gas to small commercial customers (Rate SCS1) for Vancouver Island service area. Includes billed revenues from Banner billing system, and unbilled estimates
52151	Small Commercial 2 Gas Sales (SCS2) Revenue from the sale of gas to small commercial customers (Rate SCS2) for the Vancouver Island service area. Includes billed revenues from Banner billing system, and unbilled estimates

52152	Small Commercial 1 Gas Sales (SCS1) Revenue from the sale of gas to small commercial customers (Rate SCS1) for Whistler service area. Includes billed revenues from Banner billing system, and unbilled estimates
52160	Large Commercial 1 Gas Sales (LCS1) Revenue from the sale of gas to large commercial customers (Rate LCS1) for the Vancouver Island service area. Includes billed revenues from Banner billing system, and unbilled estimates
52161	Large Commercial 2 Gas Sales (LCS2) Revenue from the sale of gas to large commercial customers (Rate LCS2) for the Vancouver Island service area. Includes billed revenues from Banner billing system, and unbilled estimates
52162	Large Commercial 3 Gas Sales (LCS3) Revenue from the sale of gas to large commercial customers (Rate LCS3) for the Vancouver Island service area. Includes billed revenues from Banner billing system, and unbilled estimates
52163	High Load Factor Sales (HLF) Revenue from the sale of gas to high load factor (HLF) customers for the Vancouver Island service area. Annual energy consumption must equal or exceed 6,000 GJ per year. The consumer is required to sign a contract for service with FEVI under this Tariff for a minimum of one year. The consumer must demonstrate a monthly coincident peak (average January and February) load factor of greater than 85%
52164	Inverse Load Factor Sales Revenue from the sale of gas to inverse load factor (ILF) customers for the Vancouver Island service area. Annual energy consumption must equal or exceed 6,000 GJ per year. The consumer is required to sign a contract for service with FEVI under this Tariff for a minimum of one year. The contract will specify a maximum daily use (Contract Demand) for the months of November, December, January, February and March. Service under this rate schedule requires daily energy use metering. The Consumer is required to pay the additional cost for a meter capable of measuring daily use.
52165	Apartment Rack Sales (S2, L1, L2) Revenue from the sale of gas to apartment rack customers in rate classes S2, L1 and L2 for the Vancouver Island service area. Rates are negotiated by customers. FEVI currently has three customers in this rate class: CFB Comox, Doman Industries and Natural Gas Vehicles.
52166	Apartment Rack Sales (LCS3) Revenue from the sale of gas to apartment rack customers in rate class LCS3 for the Vancouver Island service area. Annual energy consumption must equal or exceed 6,000 GJ per year. Currently FEVI has no customers in this rate class.
52167	Contract Rate Sales (CRXX) Revenue from the sale of gas on contract rates for the Vancouver Island service area. For rate class S2, apartments' annual energy consumption must equal or exceed 200 GJ per year. For rate class L1, apartments' annual energy consumption must equal or exceed 600 GJ per year. For rate class L2, apartments' annual energy consumption must equal for exceed 2,000 GJ per year.
52168	Large Commercial 1 Gas Sales (LCS1) Revenue from the sale of gas to large commercial customers (Rate LCS1) for the Whistler service area. Includes billed revenues from Banner billing system, and unbilled estimates
52169	Large Commercial 2 Gas Sales (LCS2) Revenue from the sale of gas to large commercial customers (Rate LCS2) for the Whistler service area. Includes billed revenues from Banner billing system, and unbilled estimates

52170	Large Commercial 3 Gas Sales (LCS3) Revenue from the sale of gas to large commercial customers (Rate LCS3) for the Whistler service area. Includes billed revenues from Banner billing system, and unbilled estimates
52180	Small Commercial 1 Propane Sales (SGS1) Revenue from the sale of propane to small commercial customers (Rate SGS1) for the Whistler service area. Includes billed revenues from Banner billing system, and unbilled estimates.
52181	Small Commercial 2 Propane Sales (SGS2) Revenue from the sale of propane to small commercial customers (Rate SGS2) for the Whistler service area. Includes billed revenues from Banner billing system, and unbilled estimates.
52191	Rate 2.1 Small Commercial Sales Revenue from the sale of gas to small commercial customers (Rate 2.1) for the Ft Nelson service area. Includes billed revenues from ABSU Energy billing system, and unbilled estimates.
52192	Rate 2 Small Commercial Propane Sales Revenue from the sale of propane to small commercial customers (Rate 2) for the Inland (Revelstoke) and Squamish service areas. Includes billed revenues from ABSU Energy billing system, and unbilled estimates.
52193	Rate 3 Large Commercial Propane Sales Revenue from the sale of propane to large commercial customers (Rate 3) for the Inland (Revelstoke) service area. Includes billed revenues from ABSU Energy billing system, and unbilled estimates.
52199	Revenue from Marketers Revenue from the sale of gas to core market customers who purchase their gas directly from marketers for the Lower Mainland, Inland, Columbia, Ft Nelson and Squamish service areas. Includes billed revenues from ABSU Energy system, and unbilled estimates.

4.3 Industrial & NGV Sales

52205	Rate 5 Industrial Firm Sales Revenue from the sale of gas to industrial general firm service customers (Rate 5) for the Lower Mainland, Inland and Columbia service areas. Includes billed revenues from ABSU Energy billing system, and unbilled estimates.
52207	Rate 7 Industrial Interruptible Sales Revenue from the sale of gas to industrial interruptible service customers (Rate 7) for the Lower Mainland and Inland service areas. Includes billed revenues from ABSU Energy billing system, and unbilled estimates.
52208	Rate 16 Interruptible LNG Revenue from the sale of LNG to interruptible Rate 16 customers. Includes billed revenues and unbilled estimates.
59001	Rate 6 NGV Station Sales Revenue from the sale of a firm supply of vehicle fuel in the Natural Gas for Vehicles Project. Includes revenues from NGV sold through public service stations. Billings are through the Energy billing system.

4.4 Transportation Sales

57001	Rate 22 Industrial Interruptible Transportation Revenue from the transportation of non-owned gas to large volume industrial interruptible customers (Rate 22) for the Lower Mainland and Inland service areas. Revenues are from ABSU Energy billing system.
57002	Rate 22A Industrial Firm Transportation Revenue from the transportation of non-owned gas to large volume industrial customers (Rate 22A) for the Inland service area. This includes basic, admin, firm demand and firm charges. Revenues are from ABSU Energy billing system.
57003	Rate 22B Industrial Firm Transportation Revenue from the transportation of non-owned gas to large volume industrial customers (Rate 22B) for the Columbia service area. This includes basic, admin, firm demand and firm charges. Revenues are from ABSU Energy billing system.
57004	Rate 25 Large Commercial Firm Transportation Revenue from the transportation of non-owned gas to large volume commercial firm customers (Rate 25) for the Lower Mainland, Inland, Columbia and Ft Nelson service areas. Revenues are from ABSU Energy billing system.
57005	Rate 27 Industrial Interruptible Transportation Revenue from the transportation of non-owned gas to large volume industrial interruptible customers (Rate 27) for the Lower Mainland and Inland service areas. Revenues are from ABSU Energy billing system.
57006	Rate 23 Large Commercial Firm Transportation Revenue from the transportation of non-owned gas to large volume commercial firm customers (Rate 23) for the Lower Mainland, Inland and Columbia service areas. Revenues are from ABSU Energy billing system.
57009	Burrard Thermal Transportation Revenue from the transportation of non-owned gas to the Burrard Thermal generation plant. Revenues are from ABSU Energy billing system.
57012	Fording Coal (Byron Creek) Transportation Revenue from the transportation of non-owned gas to Fording Coal (Byron Creek). Revenues are from ABSU Energy billing system.
57014	Rate 22B Elkview Firm Transportation Revenue from the firm transportation of non-owned gas to Elkview. Revenues are from ABSU Energy billing system.
57015	Rate 22 Bypass Transportation Revenue from the bypass transportation of non-owned gas (Rate 22). Revenues are from ABSU Energy billing system.
57016	Rate 22A Bypass Transportation Revenue from the transportation of non-owned gas to Rate 22A Bypass customers in the Inland service area. Revenues are from ABSU Energy billing system.
57017	Rate 25 Bypass Transportation Revenue from the transportation of non-owned gas to Rate 25 Bypass customers in the Inland service area. Revenues are from ABSU Energy billing system.
57018	Rate 27 Adams Lake Transportation Revenue from the transportation of non-owned gas to Adams Lake. Revenues are from ABSU Energy billing system.

57019	Rate 22 Industrial Firm Transportation Revenue from the industrial firm transportation of non-owned gas (Rate 22). Revenues are from ABSU Energy billing system.
57020	Rate 22A Industrial Interruptible Transportation Revenue from the transportation of non-owned gas to large volume industrial customers (Rate 22A) for the Inland service area. This only includes the interruptible charges. Revenues are from ABSU Energy billing system.
57021	Rate 22B Industrial Interruptible Transportation Revenue from the transportation of non-owned gas to large volume industrial customers (Rate 22B) for the Columbia service area. This only includes the interruptible charges. Revenues are from ABSU Energy billing system.
57022	Rate 22B Elkview Interruptible Transportation Revenue from the interruptible transportation of non-owned gas to Elkview. Revenues are from ABSU Energy billing system.
57023	Rate 26 NGV Transportation Transportation revenue (non commodity) version of rate 6 where a customer can choose a marketer for commodity supply.
57024	Rate 13 Large Commercial Transportation Revenue from the transportation gas to large volume commercial customers (Rate 13) for the Vancouver Island service areas.
57025	This account is used in CRB Billing rate variants which are created to collect quantities and statistical information only. **There will be no revenue or dollar posting attached to the account and it is required to support CRB processing of its quantity only.**
57030	Transportation Service – VI Joint Venture This account will include the monthly toll revenue on 'Vancouver Island Joint Venture' deliveries. The joint venture consists of seven mills: Woodfibre, Harmac, Port Mellon, Powell River, Elk Falls, Alberni, and Crofton. The offset of this account is G/L 14030 – A/R – Joint Venture Transportation.
57031	Transportation Service – BC Hydro This account will include the monthly toll revenue on BC Hydro deliveries. The offset of this account is G/L 14029 – A/R – Hydro Transportation.
57032	Transportation Service – Squamish Toll Revenue This account will include the income arising from the agreement between FEVI and the Provincial Government's Ministry of Energy & Mines to recover the monthly toll revenue on Squamish deliveries. The offset of this account is G/L 14031 – Squamish RSF.
57034	Transportation Service – FEW This G/L will be used for 2009 transportation revenue collected in cost centre 6164 from FEW.

4.5 Other Revenues (Income)

55000	Royalty Income This account will contain the income established by the agreement between FEVI and the Provincial Government's Ministry of Energy & Mines to recover the Weighted Average Wellhead Price (WAWP) on a deemed volume of gas each year. The offset of this account is G/L 14060 – Royalty Receivable.

56001	Late Payment Charges Revenue from late payment charges imposed on customers because of the failure of customers to pay their gas bills on or before the due date. Postings are from customer information system (Banner or Energy).
56101	Connection Charges Company 2000 and 3000 revenue from natural gas connection charges billed to customers through the Order Fulfilment system.
56102	NSF Cheque Charges Company 2000 and 3000 - this account will include NSF (not sufficient funds) cheque charges that have been billed back to customers through the Energy billing system for all service areas.
57904	Wheeling Charge Income – FEVI FortisBC Energy Inc. charges a monthly fee to FortisBC Energy (Vancouver Island) Inc. for pipeline capacity.
57905	SST Collection Commission This account will include monthly commission revenue from the Province of BC for collecting Social Services Tax (PST) from customers.
57907	Other Miscellaneous Revenue In company 2000, the income from the transfer of SAP lease costs to company 6000, and marketing revenues (such as Homeswest).
57909	SCP Monthly Demand Revenue This account captures the monthly demand charges related to the Southern Crossing Pipeline (SCP) billed to BC Hydro and North West Natural through the Energy billing system.
57910	SCP Net Mitigation Revenue This account will include Southern Crossing's net mitigation revenues from third parties for the use of transportation capacity from Yahk to Huntingdon (Southern Crossing Pipeline) not being utilized by the firm's transportation agreement customers.
57911	Other Revenue – GSMIP Records monthly estimates and annual true up of the Gas Supply Mitigation Incentive Plan (GSMIP) income, net of the 10% bonus accrual.
57913	NRB Overhead Recoveries This account captures the recovery of 5% overhead on labour to non-regulated businesses (NRBs) per actual timesheets submitted, per agreement with the BCUC.
57914	EMS Revenues This account captures any Energy Management Services (EMS) revenues earned over and above what is allowed to offset core costs (use 69114 for regular recoveries).
57915	Other revenue – Amortization of CIAC This account captures the other side of CIAC additions per IFRS requirements.
57916	Mt. Hayes LNG Mitigation Revenue This account will include fees that FEI pays to FEVI for using the Mt. Hayes LNG facility in accordance with the terms in the storage agreement between FEI and FEVI.
69810	Loss on Asset Sale Losses on sale of non-regulated assets. Postings are from the asset subsystem.

38101	Service Work – Revenue In company 6000, used to capture service work revenue - alterations, line hits, meter moves, customer call outs, etc. Entries are through order settlement. (See account 38201 for costs)
38201	Service Work – Cost In company 6000, used to capture service work costs - alterations, line hits, meter moves, customer call outs, etc. Entries are through order settlement. (See account 38101 for revenues)
31901	Other income – General This account will include all "other income" items not provided for elsewhere. A CO cost object is not required for entries to this account.
31902	Other Revenue – LILO This account includes the amortization of the unrecognized gains on sale and leaseback of pipeline assets to certain municipalities (currently Kelowna, Vernon, Prince George, Nelson and Creston) over the 17 year term of the operating leases.
31904	Pref. Dividend Income – FortisWest This account will include the 6.75% dividends earned on the Investment in FortisWest.
31905	Other Interest Income This account will include all interest income not provided for elsewhere.
31906	Interest Income – banking For all companies, this account will include interest income on bank balances, temporary investments and other related banking income.
31907	Other Revenue – Biomethane gas This account will include capital related costs of service for the biogas project that are attributable to all FEI customers and Biomethane Variance Account (BVA) cost of service associated with and attributable to customers electing the program. The offsetting GL account is 69129 "Biomethane Cost of Service Allocation". The capital cost of services commences amortization through delivery rates effective January 1, 2012 for 3 years. The account is NOT net of tax. The BVA cost of service is currently recovered through a new commodity rate "BERC".
31908	Other Revenue – NGV This account will include capital related costs of service for the NGV project.

4.6 Margin Stabilization Adjustments

32901	RSAM Margin Adjustment – Fort Nelson Revenue Stabilization Adjustment Mechanism (RSAM) is used as authorized by BCUC Order G-07-03 to mitigate the effect on the Company's earnings of unpredictable and uncontrollable factors that impact volumes sold. This RSAM account accumulates the margin impact of variations in the actual versus forecast volume use for customers rate 1, 2.1, 2.2, and 25 in the Fort Nelson area. The offset to this account is G/L 17927 – Revenue Stabilization Adjustment Mechanism – RSAM.

32902	Earnings Sharing Mechanism The Earnings Sharing Mechanism Account (ESM) was established to provide a 50/50 sharing mechanism between FortisBC Energy Inc. and customers. This account captures 50% of the difference between the "achieved" ROE and the "allowed" BCUC ROE, to be returned to customers in the following year through a rate rider (rider 3). The offset to this account is GL 17982.
32904	Revenue Deficiency Deferral Account (RDDA) FEVI maintains a BCUC approved Revenue Deficiency Deferral Account (RDDA) to accumulate unrecovered costs of providing service to customers or to draw down such costs where earnings exceed an allowed return as approved during the Annual Review process by the BCUC. This account is the result of the 'Vancouver Island Natural Gas Pipeline Agreement' (VINGPA), which expires in 2014, and allows FEVI to earn its allowed rate base earnings. Under the agreement, any surplus earnings for the year must be used to payback the subordinated debt. The RDDA is supported by a series of Promissory Notes Payable to FortisBC Inc. in G/L 22002. The offset to this account is GL 18201
32911	RSAM Margin Adjustment Rate 1 Revenue Stabilization Adjustment Mechanism (RSAM) is used as authorized by BCUC Order G-07-03 to mitigate the effect on the Company's earnings of unpredictable and uncontrollable factors that impact volumes sold. This RSAM accumulates the margin impact of variations in the actual versus forecast volume use for customers in rate 1 in the Lower Mainland, Inland, and Columbia areas as well as FEW. The offset to this account is G/L 17927 – Revenue Stabilization Adjustment Mechanism – RSAM.
32912	RSAM Margin Adjustment Rate 2 Revenue Stabilization Adjustment Mechanism (RSAM) is used as authorized by BCUC Order G-07-03 to mitigate the effect on the Company's earnings of unpredictable and uncontrollable factors that impact volumes sold. This RSAM accumulates the margin impact of variations in the actual versus forecast volume use for customers in rate 2 in the Lower Mainland, Inland, and Columbia areas as well as FEW. The offset to this account is G/L 17927 – Revenue Stabilization Adjustment Mechanism – RSAM.
32913	RSAM Margin Adjustment Rate 3 Revenue Stabilization Adjustment Mechanism (RSAM) is used as authorized by BCUC Order G-07-03 to mitigate the effect on the Company's earnings of unpredictable and uncontrollable factors that impact volumes sold. This RSAM accumulates the margin impact of variations in the actual versus forecast volume use for customers in rate 3 in the Lower Mainland, Inland, and Columbia areas as well as FEW. The offset to this account is G/L 17927 – Revenue Stabilization Adjustment Mechanism – RSAM.
32914	RSAM Margin Adjustment Rate 23 Revenue Stabilization Adjustment Mechanism (RSAM) is used as authorized by BCUC Order G-07-03 to mitigate the effect on the Company's earnings of unpredictable and uncontrollable factors that impact volumes sold. This RSAM accumulates the margin impact of variations in the actual versus forecast volume use for customers in rate 23 in the Lower Mainland, Inland, and Columbia areas. The offset to this account is G/L 17927 – Revenue Stabilization Adjustment Mechanism – RSAM.

32920	FEI 2010 Revenue Surplus Per the 2010/2011 NSP filing, a 2010 revenue surplus was established that must be moved to 2011. The 2010 entry will debit this account and credit deferral account 18529 monthly and will be curved based on budget.
32930	FEI Capital Incentive Mechanism Per the 2010/2011 NSP filing, this amount represents a difference in the regulated vs. finance rate base that needs to be recovered from customers over 2010/2011. The entry will debit 17982-ESM/Capital Incentive Mechanism deferral and credit this account.

4.7 Cost of Gas

62301	Cost of Gas – Rate 1 Residential Cost of gas recorded for Rate 1 Residential customers for the Lower Mainland, Inland, Columbia, Ft Nelson and Squamish service areas. Cost of gas is calculated by multiplying the calendar month sales volume by the BCUC approved gas cost recovery rates; the offset accounts are 17926 for the Midstream cost recovery and 18137 for the Commodity cost recovery and 18174 for Biomethane Variance Account.
62302	Cost of Gas – Rate 2 Commercial Cost of gas recorded for Rate 2 Small Commercial customers for the Lower Mainland, Inland, Columbia, Ft Nelson and Squamish service areas. Cost of gas is calculated by multiplying the calendar month sales volume by the BCUC approved gas cost recovery rates; the offset accounts are 17926 for the Midstream cost recovery and 18137 for the Commodity cost recovery.
62303	Cost of Gas – Rate 3 Commercial Cost of gas recorded for Rate 3 Large Commercial customers for the Lower Mainland, Inland and Columbia service areas. Cost of gas is calculated by multiplying the calendar month sales volume by the BCUC approved gas cost recovery rates; the offset accounts are 17926 for the Midstream cost recovery and 18137 for the Commodity cost recovery.
62304	Cost of Gas – Rate 4 Seasonal Cost of gas recorded for Rate 4 Seasonal customers for the Lower Mainland and Inland service areas. Cost of gas is calculated by multiplying the calendar month sales volume by the BCUC approved gas cost recovery rates; the offset accounts are 17926 for the Midstream cost recovery and 18137 for the Commodity cost recovery.
62305	Cost of Gas – Rate 5 Industrial Firm Cost of gas recorded for Rate 5 Industrial Firm Service customers for the Lower Mainland, Inland and Columbia service areas. Cost of gas is calculated by multiplying the calendar month sales volume by the BCUC approved gas cost recovery rates; the offset accounts are 17926 for the Midstream cost recovery and 18137 for the Commodity cost recovery.
62308	Cost of Gas – Rate 6 NGV Stations Cost of gas recorded for Rate 6 vehicle fuel for the Natural Gas for Vehicles Project. Cost of gas is calculated by multiplying the calendar month sales volume by the BCUC approved gas cost recovery rates; the offset accounts are 17926 for the Midstream cost recovery and 18137 for the Commodity cost recovery.
62310	Cost of Gas – Rate 7 Industrial Interruptible Cost of gas recorded for Rate 7 Industrial Interruptible Service customers for the Lower Mainland and Inland service areas. Cost of gas is calculated by multiplying the calendar month sales volume by the BCUC approved gas cost recovery rates; the offset accounts are 17926 for the Midstream cost recovery and 18137 for the Commodity cost recovery.

62314	Cost of Gas – Rate 22 Balancing/Backstopping This account includes the cost of Transportation Rate 22 Balancing and Backstopping gas for the Lower Mainland and Inland service areas. The offset account is 17926 MCRA.
62315	Cost of Gas – Rate 22 UOR/AOR This account includes the cost of Transportation Rate 22 Unauthorized Over Run Gas (UOR) and Authorized Over Run Gas (AOR) for the Lower Mainland and Inland service areas. The offset account is 17926 MCRA.
62316	Cost of Gas – Rate 23 Balancing/Backstopping/UOR/AOR This account includes the cost of Transportation Rate 23 Balancing and Backstopping Gas, Unauthorized Over Run Gas (UOR) and Authorized Over Run Gas (AOR) for the Lower Mainland and Inland service areas. The offset account is 17926 MCRA.
62317	Cost of Gas – Rate 25 Balancing/Backstopping/UOR/AOR This account includes the cost of Transportation Rate 25 Balancing and Backstopping Gas, Unauthorized Over Run Gas (UOR) and Authorized Over Run Gas (AOR) for the Lower Mainland and Inland service areas. The offset account is 17926 MCRA.
62318	Cost of Gas – Rate 27 Balancing/Backstopping/UOR/AOR This account includes the cost of Transportation Rate 27 Balancing and Backstopping Gas, Unauthorized Over Run Gas (UOR) and Authorized Over Run Gas (AOR) for the Lower Mainland and Inland service areas. The offset account is 17926 MCRA.
62319	Cost of Gas – Squamish UAF Unaccounted for gas (UAF) in company 3000 – difference between physical gas inventory and calculated gas inventory. Entries are through journal voucher each month.
62323	Cost of Gas – Transportation Service UAF This cost element will contain the transportation service unaccounted for (UAF) balance based on transportation monthly volumes UAF multiplied by UAF percentages for each area times a forecast unit cost for UAF. Entries are through journal voucher, with the offset to 17926 Midstream Cost Recovery Account.
62324	Cost of Gas – Propane Cost of propane sold to residential and commercial customers in the Inland (Revelstoke) and Squamish service areas. Cost of propane is calculated by multiplying the calendar month sales volume by the allowed unit propane cost. For Revelstoke, the difference between the actual cost of propane and the allowed cost of propane is credited to 27902; in Squamish the difference is credited to 17914.
62325	Cost of Gas Adjustment In companies 6000 and 6100, captures the cost of gas (6000) or propane (6100), calculated by multiplying the calendar month sales volume by the actual average unit gas cost or propane cost. In company 3000, captures the Furry Creek cost of propane sales and the UAF (unaccounted for) propane due to wastage or normal loss.
62326	Gas Cost Variance Account (GCVA) In company 6000, this account will contain the difference between actual and budgeted gas cost on a royalty adjusted basis. The offset of this account is 18132 – Deferral – Gas Cost Variance Account.
62327	GCVA Amortization For company 6000, the amortization of the prior year's Gas Cost Variance Account (GCVA) as allowed by the regulator. Entries are through recurring journal entry.

62328	Company Use Fuel and Gas This account includes charges to company 6000 for gas consumed in the administration and operating areas (compressors, station heaters and company use gas). The offset of this account is G/L 64104 – Facilities - Company Use Gas
62329	Cost of Gas – Rate 23 Balancing/Backstopping/UOR/AOR (Cost of Gas – Rate 23 UOR/AOR) This account includes the cost of Transportation Rate 23 Balancing and Backstopping Gas, Unauthorized Over Run Gas (UOR) and Authorized Over Run Gas (AOR) for the Lower Mainland and Inland service areas. The offset account is 17926 MCRA.
62406	Cost of Service Credits-Supplier Refunds Used to record various credits received from suppliers/producers. This includes the sale of by-products of gas to ConocoPhillips and Duke and a transportation refund from Paramount from March through October. This account settles to 17926 MCRA.
62410	Gas Brokerage & Other Fees Monthly brokerage fees posted through Accounts Payable. Gas Supply uses brokers for the purchase/sale of gas. This account will settle to 17926 MCRA.
62413	Imbalance Chg WEI & Transportation This account will include the difference between Westcoast Energy Pipeline metered and authorized deliveries and also the difference between transportation customers receipts and deliveries. Entries are through journal entry; the account will be adjusted monthly to reflect the most current balance available. The offset of this account is 25127 – Imbalance-Gas and the entries to this account settle to 17926 MCRA.
62414	Company Use Fuel & Gas This account includes credit entries to MCRA to offset the charges to company 2000 for gas consumed in the administration and operating areas (compressors, station heaters and company use gas). The offset of this account is G/L 64104 – Facilities - Company Use Gas and the entries to this account settle to the 17926 MCRA.
62415	Hedging Contracts To record hedging gains and losses of commodity derivative transactions, and also the mark-to-market value of ineffective hedges not designated for hedge accounting (as per AcG-13 Hedge Accounting Guidelines).
62416	Ft Nelson Commodity (was Base Commodity Charges) To record commodity purchases for Fort Nelson. This account will settle to Fort Nelson GCRA (17926 – order 500131).
62417	Marketer Commodity (was Non-Base Commodity) To record commodity purchases from marketers for supply to marketer customers. This account will settle to 18137.
62433	Commodity – Biogas/Biomethane To record biogas / biomethane purchases from various suppliers.

62501	GCRA – Gas Moved to Inventory The cost of gas injected into inventory at any of the underground storage facilities (Mist, LNG, Carbon, Aitken Creek, etc.). Includes the commodity price of gas as well as all tolls and fees associated with injection. This account will settle to 17926 MCRA.
62502	GCRA – Gas Moved from Inventory The cost of gas withdrawn from inventory at any of the underground storage facilities (Mist, LNG, Carbon, Aitken Creek, etc.). The gas is withdrawn from storage at the weighted average cost of the gas currently held in storage. This account will settle to 17926 MCRA.
62601	GCRA Offset – Rate 1 Offset to 62301 – Cost of Gas-Rate 1 Residential used to book Rate 1 cost of gas recovery to 17926 MCRA, 18147 CCRA or 18174 for BVA..
62602	GCRA Offset – Rate 2 Offset to 62302 – Cost of Gas-Rate 2 Commercial used to book Rate 2 cost of gas recovery to 17926 MCRA or 18147 CCRA.
62603	GCRA Offset – Rate 3 Offset to 62303 – Cost of Gas-Rate 3 Commercial used to book Rate 3 cost of gas recovery to 17926 MCRA or 18147 CCRA.
62604	GCRA Offset – Rate 4 Offset to 62304 – Cost of Gas-Rate 4 Seasonal used to book Rate 4 cost of gas recovery to 17926 MCRA or 18147 CCRA.
62605	GCRA Offset – Rate 5 Offset to 62305 – Cost of Gas-Rate 5 Industrial Firm used to book Rate 5 cost of gas recovery to 17926 MCRA or 18147 CCRA.
62608	GCRA Offset – Rate 6 Offset to 62308 – Cost of Gas-Rate 6 NGV Stations used to book Rate 6 cost of gas recovery to 17926 MCRA or 18147 CCRA.
62610	GCRA Offset – Rate 7 Offset to 62110 – Cost of Gas-Rate 7 Industrial Interruptible used to book Rate 7 cost of gas recovery to 17926 MCRA or 18147 CCRA.
62614	GCRA Offset – Rate 22 Balancing & Backstopping Offset to 62314 – Cost of Gas-Rate 22 Balancing/Backstopping used to book Rate 22 balancing and backstopping to 17926 MCRA.
62617	GCRA Offset – Rate 25 UOR/AOR Offset to 62317 – Cost of Gas-Rate 25 UOR/AOR used to book Rate 25 balancing, backstopping, UOR and AOR to 17926 MCRA.
62618	GCRA Offset – Rate 27 UOR/AOR Offset to 62318 – Cost of Gas-Rate 27 UOR/AOR used to book Rate 27 balancing, backstopping, UOR and AOR to 17926 MCRA.
62623	GCRA Offset – Transportation Service UAF Offset to 62323 – Cost of Gas-Transportation Service UAFused to book Transportation UAF to 17926 MCRA.
62626	Marketer Balancing & Backstopping

62627	MCRA/CCRA Gas Lost Billable For all companies, this account records the recoveries related to the gas lost amounts billed to third-parties for damages to the utility's pipelines. Gas lost amounts are calculated and billed for damage incidents where the volumes of gas lost are considered material, and the amounts recovered reduce the costs borne by Core customers.
62628	MCRA Recovery – Rate 23 Bal/Back/UOR/AOR (GCRA Offset – Rate 23 UOR/AOR) Offset to 62329 – Cost of Gas-Rate 23 UOR/AOR used to book Rate 23 balancing, backstopping, unauthorized overruns (UOR) and authorized overruns (AOR) to 17926 MCRA.
62701	Off System Sales Purchases This account includes commodity purchases settled to MCRA account 17926. The offset of this account is G/L 25125 – Gas Purchase Cost Liability.
62702	Off System Sales – Capacity Release This account reflects the cost of gas transported on available pipeline capacity for an incremental fee; and it is included in the Gas Supply Mitigation Incentive Program (GSMIP).
62703	Off System Sales – GSMIP This account includes the cost of gas supply transactions that relate to the Gas Supply Mitigation Incentive Program (GSMIP) including commodity gas sales, storage or transportation demand fees.
62704	Off System Sales – Non GSMIP This account includes the cost of gas supply transactions that do not relate to the Gas Supply Mitigation Incentive Program (GSMIP) including commodity gas sales, storage or transportation demand fees.
62706	GCRA offset – propane Cost of Propane in FortisBC Energy Services recovery to 18137 GCRA (Sun Peaks) or 27902 GCRA (Oliver's Landing).
62750	MCRA Recovery – Balancing Gas The sale of gas to Rate 10 Large Volume Interruptible Service customers for the Lower Mainland, Inland and Columbia service areas, billed through the Energy system and posted by ABSU. This account settles to 17926 MCRA.
62751	MCRA Recovery – Rate 14A The sale of gas to Rate 14A Term and Spot Gas Sales customers for the Lower Mainland, Inland and Columbia service areas, billed through the Energy system and posted by ABSU. This account settles to 17926 MCRA.
62754	BVA Recovery 11B This account is used for Rate 11B contracts, which are customers who purchase biomethane gas from FortisBC at the BERC rate. These customers are not monthly billed but purchase biomethane gas on occasion.
62795	Stable Rate Volume Variance to MCRA This account includes the volume variance of stable rate gas purchases to gas sales for the month transferred to the MCRA account 17926 at the average commodity cost of sale.

62796	Marketer Volume Variance to MCRA This account includes the volume and price variance of marketer gas purchases to gas sales for the month transferred to the MCRA account 17926.
62797	Foreign Exchange Gas Purchases This account includes the foreign exchange gain/loss transferred to the MCRA account 17926 and CCRA account 18137 which occurs as a result of the US dollar sales and purchases and the buying and selling of US dollars, related to the purchase and sale of gas.
62798	CCRA Volume Variance to MCRA This account includes the volume variance balances between CCRA gas purchases to gas sales for the month transferred to the MCRA account 17926 at the average cost of gas.
62801	Rider 6 – Rate 1 Rider 6 charged or recovered for midstream cost reconciliation account (MCRA – 17926). Amounts are calculated as Rate 1's consumption billed in volumes (GJs) multiplied by rider rate. Entry is through journal voucher offset to 17926.
62802	Rider 6 – Rate 2 Rider 6 charged or recovered for midstream cost reconciliation account (MCRA – 17926). Amounts are calculated as Rate 2's consumption billed in volumes (GJs) multiplied by rider rate. Entry is through journal voucher offset to 17926.
62803	Rider 6 – Rate 3 Rider 6 charged or recovered for midstream cost reconciliation account (MCRA – 17926). Amounts are calculated as Rate 3's consumption billed in volumes (GJs) multiplied by rider rate. Entry is through journal voucher offset to 17926.
62804	Rider 6 – Rate 4 Rider 6 charged or recovered for midstream cost reconciliation account (MCRA – 17926). Amounts are calculated as Rate 4's consumption billed in volumes (GJs) multiplied by rider rate. Entry is through journal voucher offset to 17926.
62805	Rider 6 – Rate 5 Rider 6 charged or recovered for midstream cost reconciliation account (MCRA – 17926). Amounts are calculated as Rate 5's consumption billed in volumes (GJs) multiplied by rider rate. Entry is through journal voucher offset to 17926.
62808	Rider 6 – Rate 6 Rider 6 charged or recovered for midstream cost reconciliation account (MCRA – 17926). Amounts are calculated as Rate 6's consumption billed in volumes (GJs) multiplied by rider rate. Entry is through journal voucher offset to 17926.
62811	Rider 6 – Interest Drawdown Rider 6 interest drawdown is a percentage of the rider 6 charged or given back to the customers which draws down the deferral account 17973 – Deferred Interest on MCRA/CCRA. The percentage is determined by Regulatory/Finance each year. 2.5% for 2006.
69912	GCRA Settlement Captures the settlement of orders to the 17926 MCRA and 18137 CCRA accounts. This account will reduce the total of accounts 62501 to 62902 to zero after settlement is run each month end.

5. COST ELEMENTS

5.1 Salaries – Management and Exempt (M&E)

60100	Retiring Allowance – M&E Retiring allowances paid to Management and Exempt employees are posted to this account from the SAP payroll system. Any retiring allowances that have been accrued in previous periods will be removed from this expense account through journal entry and charged to the liability account 25119.
60101	Salaries – M&E Regular salary earnings of Management and Exempt employees including salaries for dependent contractors, posted from the SAP payroll system.
60102	Paid Absences – M&E Includes statutory holidays, sick leave, and other leaves of absence with pay, as well as pay in lieu of statutory holidays for Management and Exempt employees, posted from the SAP payroll system.
60103	Overtime – M&E Paid overtime for Management and Exempt employees for time worked in excess of the normal hours of work, posted from the SAP payroll system.
60104	Salary Premiums – M&E Premiums and allowances paid to Management and Exempt employees, posted from the SAP payroll system. Account includes bonuses, housing allowance, car allowance, first aid allowance, but excludes gainsharing, MIP, EIP and GSMIP payouts, which are all posted to account 25119 to offset amounts accrued in prior periods.
60108	Salaries – Time Off Taken – M&E Time off taken reflects current annual vacation and accumulated days off (ADOs) that have been taken by Management and Exempt employees, posted from the SAP payroll system.
60109	Salary – Time Off Earned – M&E Time off earned reflects current year entitlements for annual vacation and ADOs not used by year end by Management and Exempt employees. This cost element balance represents the annual cost of timebanks charged to the cost centre through journal entry.
60401	Employee Incentive Plans – M&E Employee Incentive Plan accruals for Management & Exempt employees. Accruals are through journal entry based on 1/12th of the estimated annual expense each month. Amounts are trued up at year-end based on the most recent estimates from Human Resources.
60503	Salary Adjustment – M&E Salary adjustments recorded against cost centres or internal orders. Includes salary cost adjustments required at the cost centre level to resources available as well as adjustments between internal orders. Includes recoveries from third parties. Entries are through journal voucher.
69899	Transfer Salaries to Subs Cost element is used to transfer salaries between companies within the FortisBC group through journal entry. The entry is to credit this cost element and charge the intercompany account.

5.2 Salaries – COPE

60110	Retiring Allowances – COPE Retiring allowances paid to COPE employees are posted to this account from the SAP payroll system. Any retiring allowances that have been accrued in previous periods will be removed from this expense account through journal entry and charged to the liability account 25119.
60111	Salaries – COPE Regular salary earnings of regular full-time and part-time COPE employees including salaries for dependent contractors and retroactive salary increases made upon conclusion of negotiations for a new COPE agreement, posted from the SAP payroll system.
60112	Paid Absences – COPE Includes statutory holidays, sick leave, and other leaves of absence with pay, as well as pay in lieu of statutory holidays for COPE employees, posted from the SAP payroll system.
60113	Overtime – COPE Paid or banked overtime at 200% for COPE employees for time worked in excess of the normal hours of work, posted from the SAP payroll system
60114	Salary Premiums – COPE Premiums and allowances paid to COPE employees, posted from the SAP payroll system. Account includes upgroupings, shift premiums, AV differential and first aid allowances, but excludes annual incentive payouts, which are posted to account 25119 to offset amounts accrued in prior periods.
60115	Salaries & Benefits – COPE temporary Regular earnings and benefits of part-time temporary COPE employees, including pay in lieu of benefits, posted from the SAP payroll system.
60118	Salary – Time Off Taken – COPE Time off taken reflects current annual vacation and accumulated days off (ADOs) that have been taken by COPE employees, posted from the SAP payroll system.
60119	Salary – Time Off Earned – COPE Time off earned reflects current year entitlements for annual vacation and ADOs not used by year end by COPE employees. This cost element balance represents the annual cost of timebanks charged to the cost centre through journal entry.
60402	Employee Incentive Plans – COPE Employee Incentive Plan accruals for COPE employees. Accruals are through journal entry based on 1/12th of the estimated annual expense each month. Amounts are trued up at year-end based on the most recent estimates from Human Resources.
60404	Other Premiums – COPE COPE premiums recorded against internal orders, usually through journal entry.
60502	Salary Adjustment - COPE Salary adjustments recorded to cost centres or internal orders. Includes salary adjustments required at the cost centre level to resources available as well as adjustments between internal orders. Includes recoveries from third parties. Entries are through journal voucher.
60504	CS Salary Adjustment - COPE Salary adjustments recorded to cost centres or internal orders. Includes salary adjustments required at the cost centre level to resources available as well as adjustments between internal orders. Includes recoveries from third parties. Entries are through journal voucher.

60507	Salary Adjustment – CS COPE (Salary Adjustment – OPEIU) Salary adjustments recorded to cost centres or internal orders. Includes salary adjustments required at the cost centre level to resources available as well as adjustments between internal orders. Includes recoveries from third parties. Entries are through journal voucher.

5.3 Wages – IBEW

60120	Retiring Allowances – IBEW Retiring allowances paid to IBEW employees are posted to this account from the SAP payroll system. Any retiring allowances that have been accrued in previous periods will be removed from this expense account through journal entry and charged to the liability account 25119
60121	Wages – IBEW Regular wages of all IBEW employees (FTR, PTR, FTT, PTT), top ups of WCB and LTD payments, shorter work year leave (swyl) payments, and retroactive wage increases made upon conclusion of negotiations for a new IBEW agreement, posted from the SAP payroll system.
60122	Paid Absences – IBEW Includes statutory holidays, sick leave, rest time and other leaves of absence with pay for IBEW employees, posted from the SAP payroll system.
60123	Overtime – IBEW Paid or banked overtime at 100% or 200% for IBEW employees for time worked in excess of the normal hours of work, posted from the SAP payroll system
60124	Wage Premiums – IBEW Premiums and allowances paid to IBEW employees, posted from the SAP payroll system. Account includes standby duty on weekends and evenings as defined in the IBEW agreements, first aid allowance paid to employees with a valid industrial first aid certificate, and amounts paid for high time, shift premium, statutory premium, crew premium, helicopter premium.
60128	Wages – Time Off Taken – IBEW Time off taken reflects current annual vacation and shorter work year leave (swyl) that has been taken by IBEW employees, posted from the SAP payroll system.
60129	Wages – Time Off Earned – IBEW Time off earned reflects current year entitlements for annual vacation and shorter work year leave (swyl) not used by year end by IBEW employees. This cost element balance represents the annual cost of timebanks charged to the cost centre through journal entry.
60403	Employee Incentive Plans – IBEW Employee Incentive Plan accruals for IBEW employees. Accruals are through journal entry based on 1/12th of the estimated annual expense each month. Amounts are trued up at year-end based on the most recent estimates from Human Resources.
60405	Other Premiums – IBEW IBEW premiums recorded against internal orders, usually through journal entry.
60501	Wage Adjustment – IBEW Wage adjustments recorded to cost centres and internal orders. Includes wage adjustments at the cost centre level to resources available as well as adjustments between internal orders. Includes recoveries from third parties. Entries are through journal voucher.

60130	Retiring Allowances – CS (Customer Service) COPE Retiring allowances paid to COPE employees are posted to this account from the SAP payroll system. Any retiring allowances that have been accrued in previous periods will be removed from this expense account through journal entry and charged to the liability account 25119.
60131	Salaries – CS COPE Regular salary earnings of regular full-time and part-time COPE employees including salaries for dependent contractors and retroactive salary increases made upon conclusion of negotiations for a new COPE agreement, posted from the SAP payroll system.
60132	Paid Absences – CS COPE Includes statutory holidays, sick leave, and other leaves of absence with pay, as well as pay in lieu of statutory holidays for COPE employees, posted from the SAP payroll system.
60133	Overtime – CS COPE Paid or banked overtime at 200% for COPE employees for time worked in excess of the normal hours of work, posted from the SAP payroll system
60134	Salary Premiums – CS COPE Premiums and allowances paid to COPE employees, posted from the SAP payroll system. Account includes upgroupings, shift premiums, AV differential and first aid allowances, but excludes annual incentive payouts, which are posted to account 25119 to offset amounts accrued in prior periods.
60135	Salaries & Benefits – CS COPE temporary Regular earnings and benefits of part-time temporary COPE employees, including pay in lieu of benefits, posted from the SAP payroll system.
60138	Salary – Time Off Taken – CS COPE Time off taken reflects current annual vacation and accumulated days off (ADOs) that have been taken by COPE employees, posted from the SAP payroll system.
60139	Salary – Time Off Earned – CS COPE Time off earned reflects current year entitlements for annual vacation and ADOs not used by year end by COPE employees. This cost element balance represents the annual cost of timebanks charged to the cost centre through journal entry.

5.4 Benefits – M&E

60200	M&E Pension – Defined Benefit To record the defined benefit pension costs for Management & Exempt employees. Costs are accrued to estimates supplied by the Company's actuaries; for company 2000, any amounts in excess of that allowed by the BCUC are deferred to GL 17946. Expensed amounts are accrued to GL 25152.
60201	M&E Pension – Defined Contribution To record the pension contribution for Management & Exempt employees on the defined contribution pension plan. All M&E contributions are posted from the SAP payroll system; the defined benefit contributions are adjusted out of this account through journal entry. Expensed amounts are accrued to GL 25153.
60202	M&E (Retirees only) Medical Plan To record the cost of providing Medical Services Plan (MSP) coverage for retirees (M&E is included in cost element 60218 Flex Benefits). MSP is accrued as part of each payroll run based on rates configured in SAP payroll system to GL 25141.

60203	M&E Canada Pension Plan To record the Company's share of Canada Pension Plan (CPP) contributions for M&E employees. CPP is accrued as part of each payroll run based on rates configured in SAP payroll system to GL 25140.
60204	M&E Employment Insurance To record the Company's share of Employment Insurance (EI) contributions for M&E employees. EI is accrued as part of each payroll run based on rates configured in SAP payroll system to GL 25139.
60205	M&E (Retirees only) Group Life Insurance To record the cost of providing Group Life Insurance (GLI) coverage for retirees (M&E is included in cost element 60218 Flex Benefits). GLI is accrued as part of each payroll run based on rates configured in SAP payroll system to GL 25148.
60207	M&E Long Term Disability Top Up Supplemental benefit granted to long term sick leave M&E employees, calculated and expensed each month by the SAP payroll system.
60208	M&E Workers' Compensation To record the cost of Workers' Compensation Board (WCB) contributions for M&E employees. WCB is accrued as part of each payroll run based on rates configured in SAP payroll system to GL 25132.
60209	M&E (Retirees only) Extended Health To record the cost of providing Extended Health Benefits (EHB) coverage for retirees (M&E is included in cost element 60218 Flex Benefits). EHB is accrued as part of each payroll run based on rates configured in SAP payroll system to GL 25143.
60210	M&E (Retirees only) Dental To record the cost of providing Dental coverage for retirees (M&E is included in cost element 60218 Flex Benefits). Dental is accrued as part of each payroll run based on rates configured in SAP payroll system to GL 25142.
60211	M&E Benefit Program Costs Cost of administration and consultation to support the management and exempt health programs, including the costs of the employee assistance program.
60212	M&E Flex Benefit Expense To record the cost of providing benefits under the M&E flex benefits program, starting in 2005. Benefits covered under this program include medical, dental, extended health, long-term disability, group life, optional life, AD&D, business travel accident insurance, health spending account, additional days off purchased, taxable cash, in various combinations as selected by employees. Accruals are made through the SAP payroll system based on benefit dollars allocated to each employee, with the offsetting liability to GL 25147.
60215	M&E Benefits Adjustments To record miscellaneous benefits adjustments for M&E employees not captured elsewhere.
60219	M&E ESP - Employee Savings Plan To record company costs of the employee savings plan for M&E employees. Postings are from the SAP payroll system.
60222	M&E Empl Share Purchase 10% Top-up This account has been created to record the company cost for the 10% top up on Share purchase and dividend re-investment for Fortis Employee Share Purchase Plan for M&E employees.

60223	CS COPE Pension – Defined Benefit (CS COPE Pension Contributions) To record the pension contribution for CS COPE employees on the defined benefit pension plan. All CS COPE contributions are posted from the SAP payroll system; each quarter the contributions are adjusted to one-quarter of the annual defined benefit expense as calculated by the Company's actuaries. Amounts are accrued to GL 25149.
60224	CS COPE Medical Plan To record the cost of providing Medical Services Plan (MSP) coverage for CS COPE employees. MSP is accrued as part of each payroll run based on rates configured in SAP payroll system to GL 25141.
60225	M&E OPEB These G/Ls are required to record the cost of Other Post Employment Benefits for current employees (new benefit loading effective 2010).
60226	CS COPE Canada Pension Plan To record the Company's share of Canada Pension Plan (CPP) contributions for CS COPE employees. CPP is accrued as part of each payroll run based on rates configured in SAP payroll system to GL 25140.
60227	CS COPE Employment Insurance To record the Company's share of Employment Insurance (EI) contributions for CS COPE employees. EI is accrued as part of each payroll run based on rates configured in SAP payroll system to GL 25139.
60228	CS COPE Group Life Insurance To record the cost of providing Group Life Insurance (GLI) coverage for CS COPE employees. GLI is accrued as part of each payroll run based on rates configured in SAP payroll system to GL 25148.

5.5 Benefits – COPE

60231	COPE Pension – Defined Benefit To record the pension contribution for COPE employees on the defined benefit pension plan. All COPE contributions are posted from the SAP payroll system; each quarter the contributions are adjusted to one-quarter of the annual defined benefit expense as calculated by the Company's actuaries. Amounts are accrued to GL 25149.
60232	COPE Medical Plan To record the cost of providing Medical Services Plan (MSP) coverage for COPE employees. MSP is accrued as part of each payroll run based on rates configured in SAP payroll system to GL 25141.
60233	COPE Canada Pension Plan To record the Company's share of Canada Pension Plan (CPP) contributions for COPE employees. CPP is accrued as part of each payroll run based on rates configured in SAP payroll system to GL 25140.
60234	COPE Employment Insurance To record the Company's share of Employment Insurance (EI) contributions for COPE employees. EI is accrued as part of each payroll run based on rates configured in SAP payroll system to GL 25139.

60235	COPE Group Life Insurance To record the cost of providing Group Life Insurance (GLI) coverage for COPE employees. GLI is accrued as part of each payroll run based on rates configured in SAP payroll system to GL 25148.
60236	COPE Long Term Disability To record the cost of providing Long Term Disability (LTD) coverage for COPE employees. LTD is accrued as part of each payroll run based on rates configured in SAP payroll system to GL 25144.
60237	COPE Long Term Disability Top Up Supplemental benefit granted to long term sick leave COPE employees, calculated and expensed each month by the SAP payroll system.
60238	COPE Workers' Compensation To record the cost of Workers' Compensation Board (WCB) contributions for COPE employees. WCB is accrued as part of each payroll run based on rates configured in SAP payroll system to GL 25132.
60239	COPE Extended Health Benefits To record the cost of providing Extended Health Benefits (EHB) coverage for COPE employees. EHB is accrued as part of each payroll run based on rates configured in SAP payroll system to GL 25143.
60240	COPE Dental To record the cost of providing Dental coverage for COPE employees. Dental is accrued as part of each payroll run based on rates configured in SAP payroll system to GL 25142.
60241	COPE Empl Share Purchase 10% Top-up This account has been created to record the company cost for the 10% top up on Share purchase and dividend re-investment for Fortis Employee Share Purchase Plan for COPE employees.
60245	COPE Benefits Adjustments To record miscellaneous benefits adjustments for COPE employees not captured elsewhere.
60246	COPE ESP - Employee Savings Plan To record company costs of the employee savings plan for COPE employees. Postings are from the SAP payroll system.
60247	COPE Flex Benefit To record the cost of providing benefits under the COPE flex benefits program, starting in 2008. Benefits covered under this program include medical, dental, extended health, long-term disability, group life, optional life, AD&D, business travel accident insurance, health spending account, additional days off purchased, taxable cash, in various combinations as selected by employees. Accruals are made through the SAP payroll system based on benefit dollars allocated to each employee, with the offsetting liability to GL 25191.
60248	CS (Customer Service) COPE Long Term Disability To record the cost of providing Long Term Disability (LTD) coverage for CS COPE employees. LTD is accrued as part of each payroll run based on rates configured in SAP payroll system to GL 25144.
60251	CS COPE Fringe Benefits

60252	CS COPE Workers' Compensation To record the cost of Workers' Compensation Board (WCB) contributions for CS COPE employees. WCB is accrued as part of each payroll run based on rates configured in SAP payroll system to GL 25132.
60253	CS COPE Extended Health Benefits To record the cost of providing Extended Health Benefits (EHB) coverage for CS COPE employees. EHB is accrued as part of each payroll run based on rates configured in SAP payroll system to GL 25143.
60254	CS COPE Dental To record the cost of providing Dental coverage for CS COPE employees. Dental is accrued as part of each payroll run based on rates configured in SAP payroll system to GL 25142.
60255	COPE OPEB These G/Ls are required to record the cost of Other Post Employment Benefits for current employees (new benefit loading effective 2010).
60256	CS COPE Empl Share Purchase 10% Top-up This account has been created to record the company cost for the 10% top up on Share purchase and dividend re-investment for Fortis Employee Share Purchase Plan for CS COPE employees.
60257	CS COPE Benefits Adjustments (Benefits Adjustments) To record miscellaneous benefits adjustments for CS COPE employees not captured elsewhere.
60258	CS COPE ESP Employee Savings Plan To record company costs of the employee savings plan for CS COPE employees. Postings are from the SAP payroll system.
60259	CS COPE Flex Benefit To record the cost of providing benefits under the CS COPE flex benefits program, starting in 2008. Benefits covered under this program include medical, dental, extended health, long-term disability, group life, optional life, AD&D, business travel accident insurance, health spending account, additional days off purchased, taxable cash, in various combinations as selected by employees. Accruals are made through the SAP payroll system based on benefit dollars allocated to each employee, with the offsetting liability to GL 25191.

5.6 Benefits – IBEW

60261	IBEW Pension – Defined Benefit To record the pension contribution for IBEW employees on the defined benefit pension plan. All IBEW contributions are posted from the SAP payroll system; each quarter the contributions are adjusted to one-quarter of the annual defined benefit expense as calculated by the Company's actuaries. Amounts expensed are accrued to GL 25149.
60262	IBEW Medical Plan To record the cost of providing Medical Services Plan (MSP) coverage for IBEW employees. MSP is accrued as part of each payroll run based on rates configured in SAP payroll system to GL 25141.
60263	IBEW Canada Pension Plan To record the Company's share of Canada Pension Plan (CPP) contributions for IBEW employees. CPP is accrued as part of each payroll run based on rates configured in SAP payroll system to GL 25140.

60264	IBEW Employment Insurance To record the Company's share of Employment Insurance (EI) contributions for IBEW employees. EI is accrued as part of each payroll run based on rates configured in SAP payroll system to GL 25139.
60265	IBEW Group Life Insurance To record the cost of providing Group Life Insurance (GLI) coverage for IBEW employees. GLI is accrued as part of each payroll run based on rates configured in SAP payroll system to GL 25148.
60266	IBEW Long Term Disability To record the cost of providing Long Term Disability (LTD) coverage for IBEW employees. LTD is accrued as part of each payroll run based on rates configured in SAP payroll system to GL 25144.
60267	IBEW Long Term Disability Top Up Supplemental benefit granted to long term sick leave COPE employees, calculated and expensed each month by the SAP payroll system.
60268	IBEW Workers' Compensation To record the cost of Workers' Compensation Board (WCB) contributions for IBEW employees. WCB is accrued as part of each payroll run based on rates configured in SAP payroll system to GL 25132.
60269	IBEW Extended Health Benefits To record the cost of providing Extended Health Benefits (EHB) coverage for IBEW employees. EHB is accrued as part of each payroll run based on rates configured in SAP payroll system to GL 25143.
60270	IBEW Dental Plan To record the cost of providing Dental coverage for IBEW employees. Dental is accrued as part of each payroll run based on rates configured in SAP payroll system to GL 25142.
60271	IBEW Flex Benefit To record the cost of providing benefits under the IBEW flex benefits program, starting in 2007. Benefits covered under this program include medical, dental, extended health, long-term disability, group life, optional life, AD&D, business travel accident insurance, health spending account, additional days off purchased, taxable cash, in various combinations as selected by employees. Accruals are made through the SAP payroll system based on benefit dollars allocated to each employee, with the offsetting liability to GL 25189.
60275	IBEW Benefits Adjustments To record miscellaneous benefits adjustments for IBEW employees not captured elsewhere.
60276	IBEW Empl Share Purchase 10% Top-up This account has been created to record the company cost for the 10% top up on Share purchase and dividend re-investment for Fortis Employee Share Purchase Plan for IBEW employees.
60277	IBEW OPEB These G/Ls are required to record the cost of Other Post Employment Benefits for current employees (new benefit loading effective 2010).
60278	IBEW ESP Employee Savings Plan To record company costs of the employee savings plan for IBEW employees. Postings are from the SAP payroll system.

5.7 Other Benefit Costs

60409	Other Post Employment Benefits To record the other post employment benefit expense for all employees. Costs are accrued to estimates supplied by the Company's actuaries; for company 6000, any amounts in excess of that allowed by the BCUC are expensed to GL 60415.
60410	Employee Incentive Plans – CS (Customer Service) COPE (Gainsharing – CS COPE) Employee incentive Plan accruals for CS COPE employees. Accruals are through journal entry based on 1/12th of the estimated annual expense each month. Amounts are trued up at year-end based on the most recent estimates from Human Resources.
60414	Stock Compensation Expense To record the estimated stock compensation expense for the quarter, calculated and booked by Finance through journal voucher. Liabilities are recorded through intercompany payable to FortisBC Holdings Inc.; in FortisBC Holdings Inc., the offset is G/L 21103 – Stock Compensation Liability.
60298	Benefits Adjustment Year End Miscellaneous year-end corporate benefits adjustment posted by Finance.
60415	FEVI Pension & OPEB Adjustment For Company 6000, this account will be used to book the difference between the Pension and Other Post Employment Benefits (OPEB) expense as calculated by the Company's actuaries, and the allowed OPEB expense as filed with the BCUC.
60506	Pension Adjustments & Letters of Credit Used to adjust pension expenses to orders.
69105	Recoveries – Employee Benefits Recoveries of employee benefits paid by FortisBC; postings are from the payroll system.

5.8 Employee Expenses

60301	Employee - Course Fees Amounts paid to educational institutions, suppliers of equipment, industrial and professional organizations for course registration and tuition.
60302	Employee Travel (Non-Training) Employee expenses related to out-of-town travel and travel to/from meetings, but not travel related to training. Travel expenses include flights and airport improvement fees, hotel rooms, telephone charges, taxis, parking and other incidental travel expenses. Does not include mileage allowances (60308), cost of meals (60303), living out allowances (60306) or entertainment expenses (60303).
60303	Meals & Entertainment (Non-Training) Cost of all meals and entertainment events that are not training-related. (Entertainment events include tickets to sporting or cultural events and related expenses while attending those functions such as room rentals, cost of travel to and from, cost of parking or of private boxes.) Not to include those meals/entertainment expenses specifically provided for under 100% tax deductible; those costs incurred by the employer for the benefit of all employees or related to an event whose primary purpose is to benefit a registered charity (60310). Not to include meals/entertainment expenses related to training (60305).

60304	Employee Travel (Training) Training-related only: employee expenses related to both in town and out-of-town travel to/from courses, such as flights and airport improvement fees, hotel rooms, telephone charges, taxis, parking and other incidental travel expenses. Does not include cost of meals or entertainment expenses (60305) related to these courses. Travel that is not related to training should be coded to 60302.
60305	Meals & Entertainment (Training) Training-related only cost of meals and entertainment events. Meals and entertainment not related to training should be coded to 60303. Not to include those meals/entertainment expenses specifically provided for under 100% tax deductible; those costs incurred by the employer for the benefit of all employees or related to an event whose primary purpose is to benefit a registered charity (60310).
60306	Employee Allowance – LOA & Meal Meal Allowance and Living Out Allowance (LOA) paid to employees that stay out of town overnight outside regular work headquarters. The allowance is effective when employees travel out of town to perform work, provide relief for employees in other locations, help out locations that are shorthanded, and/or travel to larger centres for training. Living Out Allowances are charged against a job number determined such as the last job of the day or the job the employee spent the most time on.
60308	Allowance – Mileage Cost of company use of employee owned vehicles while on company business at designated rates.
60310	Company Functions Included in this account is the cost of meals and entertainment provided by the employer for the general benefit of all employees such as Christmas parties, retirement parties, golf tournaments, etc. All other meals and entertainment expenses should be coded to either 60303 or 60305.
60313	Employee Hiring Cost of hiring employees, including advertising in newspapers and other publications. Entries are through Accounts Payable.
60314	Employee Relocation Cost of employee relocation, excluding cost of meals which should be captured in cost element 60303. This cost is borne by the cost centre. Entries are through journal entry or postings from Accounts Payable.
60315	Employee Expenses – Adjustment Employee expense adjustments recorded to VP cost centres in the Co module. Balances in the account should be zero. Entries are through journal voucher.
69307	Credit Card Purchases (default) – for Accounts Payable Use Only Default account for purchases of materials and services using corporate credit card. This cost element will be used by Accounts Payable to process monthly credit card statements which have not been reconciled.

5.9 Material & Supplies

62101	Personal Supplies Purchase and cleaning of uniforms, smocks, hard hats, safety shoes, gloves, and other personal supplies. Entries are through Accounts Payable.

62102	Office Furniture and Equipment Purchase, renting, leasing, repair & maintenance of office furniture and equipment, including postage meters and photocopying machines, and the cost per copy when contracts are based on copies produced. Amounts under the minimum capitalization level are charged to an O&M order; amounts over the level are charged to the appropriate Capital Internal Order. Entries are through Accounts Payable. *Note: Purchase of telephones and related equipment is not charged here, but to cost element 64101.*
62103	Office Supplies and Stationary Office supplies, newspapers, magazines, printing and books. Includes subscriptions for newspapers and periodicals, photocopying of unbound documents, reproduction of drawings, BC Hydro print shop charges for printing services provided to FortisBC, the cost of printed documentation such as specifications, agreements, tender documents, gifts & greeting cards. Entries are through Accounts Payable.
62201	Tools The initial purchase or replacement of instruments, tools and equipment. Amounts under the minimum capitalization level are charged to an O&M order; amounts over the level are charged to the appropriate Capital Internal Order. Entries are through Accounts Payable for external purchases, or through the Materials Management system when items are removed from inventory.
62202	Miscellaneous Field Materials The purchase of materials to be consumed in the construction of assets, and not covered by another specific cost element, including shoring material, road plates, barricades and other items. Entries are through Accounts Payable for external purchases, or through the Materials Management system when items are removed from inventory.
62203	Shop Materials The purchase of materials to be used in shop activities, including repair parts for tools, conditioner used for preventive maintenance measures, compressed gases, solvents, chemicals, reagents and other materials utilized in gas analysis work and processing operation, and any other miscellaneous shop materials, not specified above. Entries are through Accounts Payable for external purchases, or through the Materials Management system when items are removed from inventory.
62205	Road Surfacing Materials The purchase of blacktop (asphalt) and associated materials used for repairing road surfaces disturbed during work on gas plant facilities. Entries are through Accounts Payable.
62206	Backfill Materials The purchase of gravel, sand and topsoil used to restore excavated surfaces. Entries are through Accounts Payable.
62207	Gas Meters The purchase of meters or devices used in measuring the quantity of gas delivered to users, whether actually in service or held in reserve (storage). Entries are through the Materials Management system when items are removed from inventory.

62208	Gas Meters Parts The purchase of associated meter parts and equipment, such as locks, gauges, meters bars, risers, seals, guards, etc. Entries are through the Materials Management system when items are removed from inventory.
62209	Gas Regulators The purchase of devices used for reducing varying high pressure to a constant lower pressure throughout a range of flows. Entries are through the Materials Management system when items are removed from inventory.
62210	Gas Regulator Parts The purchase of associated parts and equipment for gas regulators. Entries are through Accounts Payable for external purchases, or through the Materials Management system when items are removed from inventory.
62211	Gas Pipe – Steel The purchase of steel gas pipe for the gas supply system, to direct the flow of gas to customers. Entries are through the Materials Management system when items are removed from inventory.
62212	Gas Valves and Fittings – Steel The purchase of any non-pipe items which form part of the pressurized steel gas system. Entries are through the Materials Management system when items are removed from inventory.
62214	Gas Valves and Fittings – Polyethylene The purchase of any non-pipe items which form part of the pressurized polyethylene gas system. Entries are through the Materials Management system when items are removed from inventory.
62215	Gas Pipe – Polyethylene The purchase of polyethylene gas pipe for the gas supply system, to direct the flow of gas to customers. Entries are through the Materials Management system when items are removed from inventory.
62218	Exempt Materials Captures the costs of exempt material issued from stores to bin usage at muster stores and truck stops e.g. small pieces of pipe and fittings, welding rods, paint, etc. Entries are through the Materials Management system when items are removed from inventory.
62219	Valves & Fittings for Transmission & Stations The purchase of valves & fittings for transmissions and stations. Entries are through Accounts Payable for external purchases, or through the Materials Management system when items are removed from inventory.
62220	Fittings & House Lines The purchase of fittings and house lines. Entries are through the Materials Management system when items are removed from inventory.

62221	Radio Equipment Purchase, renting, leasing, repair & maintenance of radio equipment Amounts under the minimum capitalization level are charged to an O&M order; amounts over the level are charged to the appropriate Capital Internal Order. Entries are through Accounts Payable.
69301	Inventory Write Down/ Revaluation Account To record losses (gains) on the disposal of inventory in excess of the provision for loss on disposal of obsolete inventory account. Also used to record the additions to the provision account. This cost element is directly posted to; no automatic account assignments.
69304	Inventory Shrinkage & Adjustments Includes losses (gains) on inventory shrinkage during system inventory counts as well as manual sample counts. Configured system transactions are directed to this cost element. Movement types 701 and 702 default to this cost element from the Materials Management system.
69306	Small Differences – Invoice Verification Collects 3-way matching differences on invoice verification which fall within tolerance limits, posted from the Materials Management system.
69309	Freight Charges Direct freight charges on invoices posted through Accounts Payable.
69310	Inventory – SubContractor Costs Account is used to record labour costs incurred by the SubContractor on inventory issued for work. Amount will settle through account 69943 – Settlement: Inv – SubContractor Costs back to account 15088 Inventory – SubContractor Clearing Account so the net income impact is zero.
60505	Material Adjustments Various adjustments to material costs, made at a high level. Used for all Manufacturing and Muster Stock clearing entries. Includes recoveries from third parties.

5.10 Fees & Admin Costs

63102	Government Fees Fees paid to a government agency for such items as testing of gas revenue meters at regular intervals in accordance with Federal Government re-verification regulations, other gas and electrical safety and inspection fees, overweight and oversize permits, elevator inspection fees, trailer licences, disputed meter tests, D.O.C. radio license fees, etc. Amounts are posted through Accounts Payable.
63103	Membership Dues Membership fees and dues paid by the company, in any association, organization or club; includes both individual and corporate memberships in professional organizations. Excludes dining/golf/recreation dues or fees which are non-deductible for tax purposes (use cost element 63114). Amounts are posted through Accounts Payable.
63104	BCUC Assessments (for Finance Use Only) Monthly accruals and annual adjustment of assessments paid to BCUC quarterly, annually and special assessments. Amounts are posted through recurring journal voucher.

63105	External Auditors Fees (for Finance Use Only) Monthly accruals and annual adjustment of fees paid to external auditing firms for the interim and annual audits, and special projects. Amounts are posted through recurring journal voucher. Work done by external auditors which is of a non-audit nature (consulting, administrative) should not be charged here, but to cost elements 63101 or 65202.
63106	Legal Fees and Retainers Legal fees, retainers and other associated legal expenses. Postings are through Accounts Payable.
63108	Board Meeting Expenses Expenses incurred by company 1000 related to Board of Directors Meetings. Postings are through Accounts Payable.
63109	Continuing / Shared Services Charges to FortisBC Huntingdon Inc. or Inland Energy Corp. for continuing/shared services provided by FortisBC Energy Inc. Entries are through recurring journal voucher.
63110	Directors' Fees and Expenses Expenses incurred by company 1000 related to Directors' fees, the value of DSUs (Deferred Share Units) held by directors, and other miscellaneous expenses. Entries are through payroll, through journal entry for estimated DSU fair value adjustments, and through Accounts Payable for miscellaneous expenses.
63111	Charitable Donations Donations to registered charities, posted through Accounts Payable. Receipts for charitable donations should be forwarded to Financial Accounting for summarization in the corporate tax returns. This cost element can be used only by cost centre 2267 in company 2000 and cost centre 1042 in company 1000.
63112	Corporate Sponsorships Amounts paid for sponsorship of community events, scholarships and awards that fall under the categories of environment, education, or community development. Sponsorships should be coordinated through the Community Investment Committee (contact the Community Investment Manager). Postings are through Accounts Payable.
63113	Shareholder Expenses Amounts paid by company 1000 related to the company's shareholders such as filing fees, stock exchange listing fees, transfer agent fees, costs dividend notices, Annual General Meeting costs, etc.
63114	Golf/Recreation Dues/Fees – Non-Deductible Non-deductible dues and fees relating to dining, recreational or sporting clubs. e.g. golf or dining club dues and memberships and green fees.
63115	Management Services Expense Amounts paid to FortisBC Energy Inc. or FortisBC Holdings Inc. for management services, including gas management fees and gas control management fees. Entries are through recurring journal voucher.
63117	Political Contributions Contributions to political parties, either through direct donation or sponsorship of a political event. Account is only used by company 1000; postings are through Accounts Payable.

63118	Management Services Expense – Other Amounts paid to Fortis BC for management services for the shared executives.
63119	Restricted HST This account will be used to capture HST that is not recoverable as an input tax credit.
63202	Land Acquisition Fees All costs and fees with respect to land and land right acquisitions, including legal fees in connection with search and registration which includes: all search, registration, and registrar of companies' fees, notary fees, property appraisal costs, etc. Postings are through Accounts Payable.
63203	Easement and Rights-of-Way All costs and fees related to acquiring easements and rights-of-way including bridges, railway and foreshore crossings. Postings are through Accounts Payable.
63301	Communications – Investors Costs related to financial reporting to shareholders, primarily the costs of printing and distributing the Quarterly and Annual Reports. Postings are through Accounts Payable.
63303	Communications – Public Relations The cost of informing the public regarding energy use and other issues of public interest. This includes the cost of direct mail-outs, bill stuffers, television advertising, etc. Postings are through Accounts Payable. *Note: Does not include the cost of employee communication publications (included in cost element 63304) or investor communications (included in cost element 63301)*
63304	Communications – Employee The cost of employee communication programs, including printed material and the cost of meetings and other programs - coordinated and administered by Public Affairs. Postings are through Accounts Payable.
63401	Advertising – Media Advertising in newspapers including space and production costs. Advertising in trade and other publications, including space and production costs. Radio advertising including time and production or purchase of commercial material. Television advertising including time and production costs. Postings are through Accounts Payable.
63402	Advertising - Printed Matter Direct mail, pamphlets, brochures and similar materials for sales promotion purposes. Postings are through Accounts Payable.
63403	Miscellaneous Advertising Display materials for dealers, costs of exhibits in exhibitions and fairs, advertising such as transit vehicles, transit shelters, billboards, mail posters, stadium or building advertising, and small branded items used for promotional purposes. Also included are sponsorships of a promotional nature (see also corporate sponsorships 63112) Postings are through Accounts Payable. Does not include charitable donations (63111) or advertising related to hiring employees (60313).

63501	Administration – Postage Cost of bulk mail for customers' bills, metered mail for general office use, postage stamps, registry and postal insurance fees and postage due charges. Postings are through Accounts Payable.
63502	Administration – Couriers and Freight Cost of couriers and miscellaneous freight charges for deliveries Postings are through Accounts Payable.
63503	Administration – Contracts and Outside Services Work performed and services supplied by outside companies, and not covered by a specific cost element. Includes costs associated to store company records offsite, temporary help agencies, health monitoring etc.
63504	Miscellaneous Administration Expenses Miscellaneous administration expenses of a non-recurring or unusual nature which are not covered by a specific cost element. This account should only be used as a last resort where no other account is appropriate. Entries are from Accounts Payable.
63505	ICE Levy Tax This account will include the .4% Social Services Tax paid to the BC government on purchases of electricity, natural gas, fuel oil and propane received after September 1/2007. Refunds will apply once this account has reached a limit of $100,000.
63506	Gas Lost – Billable For all companies, this account records the gas lost amount billed to third-parties for damages to the utility's pipelines. Gas lost amounts are calculated and billed for damage incidents where the volumes of gas lost are considered material.
63601	Radio – Site Rentals Rent related to radio sites (see 63602 for radio licences). Postings are through Accounts Payable.
63602	Radio – Government Licences Radio licence fees. Postings are through Accounts Payable.
63901	Damages to Third-Party Utilities Costs related to repairing damage to third-party utilities, including filing fees and damage settlement payments. Postings are through Accounts Payable.
63902	Insurance (Finance use only) Monthly accruals and annual true ups for insurance costs, including general liability, all risk, directors' liability, umbrella, excess liability, boiler & machinery. Entries are through recurring journal voucher.
63903	Injuries and Damages Costs in connection with accidents including all expenses, except legal expenses incurred in settlement of injuries and damage claims (see 63106). Excludes costs coded to 63901 Damages to Third-Party Utilities.
63904	Bad Debts Expense – Rate 1 (For Finance Use Only) This account contains the provision for estimated unrecoverable accounts receivable for Rate 1 Customers. Each month a provision is estimated based on bad debt experience and the balance in the aged accounts receivable accounts, and booked through journal entry.

63905	Bad Debts Expense – Rate 2 and 3 (For Finance Use Only) This account contains the provision for estimated unrecoverable accounts receivable for Rate 2 and 3 Customers. Each month a provision is estimated based on bad debt experience and the balance in the aged accounts receivable accounts, and booked through journal entry.
63906	Bank Charges Bank charges, including cash management fees, maintenance fees, credit card fees, wire charges, bank confirmation charges, etc. Postings are through the bank interface program and through journal entry.
63907	Collection Costs – General Includes commissions and bonuses paid to collection agencies for the collection of overdue accounts and the costs of obtaining credit reports. Postings are through Accounts Payable.
63908	Bad Debts Expense – Industrial (For Finance Use Only) This account contains the provision for estimated unrecoverable accounts receivable for Rate 14 and other Industrial Customers. Each month a provision is estimated based on bad debt experience and the balance in the aged accounts receivable accounts, and booked through journal entry.
63909	Customer Service Refunds This account is used to charge amounts that are refunded to customers in situations where the Company has not provided an appropriate level of service to the customer. This account is only to be used with the approval of a Manager or more senior level employee. This account should not be used to record write-offs of accounts receivable or other uncollectible amounts. Postings are through journal entry based on information from the Energy system.
63910	Bad Debts Expense – System Alteration To record system alteration receivable accounts either sent to collection agencies or written off.
63911	Bad Debts Expense – System Damage To record system damage receivable accounts either sent to collection agencies or written off.
63913	Customer Rebates This account will include the rebates we pay out to customers for converting vehicles and appliances to natural gas (DSM).

5.11 Facilities

30801	Lease Costs This account will include the expense related to FEVI's two compressors lease agreements. The account is debited as automatic payments are deducted from G/L 13840 – CIBC Bank Account CDN, and remitted to the Canadian Western Bank which holds the debt instruments on these compressors; one for Coquitlam, and one for Port Mellon.
64101	Facilities – Communications Costs of communications such as telephone (local, long distance, mobile), answering services and cost of moving telephones. Includes the cost of purchasing communication equipment, such as telephones and related equipment. Data line charges should be coded to 64122. Entries are through Accounts Payable.

64102	Facilities – Heat & Light (3rd Party) Cost of heat and electricity used in the operation of buildings, paid to parties other than FortisBC. Payments are primarily to BC Hydro, paid through Accounts Payable.
64103	Facilities – Water Annual water fees paid to cities and municipalities for FortisBC facilities (sewer fees are GL 64118). Payments are through Accounts Payable.
64104	Facilities – FortisBC Gas Charges Cost of using gas from own system for use in compressors, line heaters, LNG, offices, and muster stations in the administration and operating areas of the Company. The offset of this account is G/L 62414 – Company Use Fuel & Gas. Postings are through journal entry.
64105	Facilities – Carpet & Upholstery Cost associated with cleaning of carpets and upholstered furniture. Postings are through Accounts Payable.
64106	Facilities – Catch Basin & Sump Cost associated with cleaning of storm drain catch basins in roadways and parking lots as well as sump maintenance. Postings are through Accounts Payable.
64107	Facilities – Electrical Maintenance Cost associated with electrical maintenance and repairs on buildings, as well as all exterior lighting including parking lots and walk ways. Postings are through Accounts Payable.
64108	Facilities – Fence/Door/Gate Repair Costs associated with maintenance and repair of fencing and gates (costs relating to locks are 64113). Postings are through Accounts Payable.
64109	Facilities – Garbage Costs associated with non-recyclable garbage disposal. Postings are through Accounts Payable.
64110	Facilities – HVAC Costs associated with maintenance of the heating, ventilation and air conditioning (HVAC) system including changing of filters, reprogramming of control systems, etc. Postings are through Accounts Payable.
64111	Facilities – Janitorial Costs associated with daily janitorial cleaning of buildings. Postings are through Accounts Payable.
64112	Facilities – Landscaping Costs associated with maintaining trees, shrubs, lawns and sprinkler systems (pest control is 64114). Postings are through Accounts Payable.
64113	Facilities – Locksmith Costs associated with repairing and changing locks as well as key replacement. Postings are through Accounts Payable.
64114	Facilities – Pest Control Costs associated with controlling rodents, bugs etc. both internally and externally. Postings are through Accounts Payable.
64115	Facilities – Plumbing Costs associated with plumbing repairs, leaking facets, leaking or broken water and sewer pipes etc. Postings are through Accounts Payable.

64116	Facilities – Recycling Costs associated with recycling of cardboard and paper products. Postings are through Accounts Payable.
64117	Facilities – Security Costs associated with security guard services and security system maintenance. Postings are through Accounts Payable.
64118	Facilities – Sewer Annual sewer fees paid to cities and municipalities for FortisBC facilities (water fees are GL 64103). Payments are through Accounts Payable.
64119	Facilities – Snow Removal Costs associated with the removal of snow on FortisBC's premises. Payments are through Accounts Payable
64120	Facilities – Window Cleaning Costs associated with window cleaning in FortisBC's buildings. Payments are through Accounts Payable
64121	Facilities – Yard Maintenance Costs associated with yard maintenance. Payments are through Accounts Payable
64122	Facilities – Data Line Charges Data line charges such as internet (ISP) costs, LAN and WAN costs. Charges are coded through Accounts Payable. See also 64101 Facilities – Communications for voice communication charges.
64123	Facilities – Building Maintenance Costs associated with building (structure) maintenance such as roof repairs, tiles, wall inspections, etc. Payments are through Accounts Payable
64124	Southern Crossing Lease Rental and lease costs associated with FortisBC occupied buildings posted through Accounts Payable and the lease costs associated with the Southern Crossing Pipeline posted through journal entry.
64125	Facilities – Fire Safety System Costs associated with building fire alarms, sprinkler system, fire extinguishers, and emergency systems. Postings are through Accounts Payable.
64126	Facilities – Elevator Costs associated with elevator maintenance and permits. Postings are through Accounts Payable.
64127	Facilities – Signage Costs associated with external and internal signs and nameplates. Postings are through Accounts Payable.
64128	Facilities – Moves Costs associated with employee move. Postings are through Accounts Payable.
64129	Facilities – Equipment Maintenance Costs associated with the maintenance of equipment such as air tools, pneumatics, overhead cranes

64130	Facilities – Roofs Costs associated with roof maintenance. Postings are through Accounts Payable.
64131	Construction or renovation on Facilities & property. Postings are through Accounts Payable.
64132	Remediation work on contamination removal for building or yards i.e. asbestos removal. Postings are through Accounts Payable.
64133	Facilities - Communication Adjustment Employee expense adjustments recorded to VP cost centres in the Co module. Balances in the account should be zero. Entries are through journal voucher.
65101	Rentals – Building/General Rental and lease costs associated with FortisBC occupied buildings posted through Accounts Payable.

5.12 Vehicles

60504	Vehicle Cost Adjustment Miscellaneous adjustment to vehicle costs. Includes recoveries from third parties. Entries are through journal voucher.
65102	Rentals – Trucks Rental of trucks from outside rental agencies. Entries are through Accounts Payable.
65103	Rentals – Backhoes Rental of backhoes without operators. (Contract backhoes are charged to cost element 65208). Postings are through Accounts Payable.
65104	Vehicle Purchases Covers the purchase of vehicles. This cost element should only be used in conjunction with a Capital Internal Order. Postings are through Accounts Payable.
65105	Leased Vehicles – Management Cost of leasing and operating leased vehicles for management personnel (includes repairs and maintenance and insurance costs).
66101	Company Vehicles – Cars (Vehicles – Cars) Costs of operating assigned and/or pooled FortisBC cars. Postings are through Accounts Payable.
66102	Company Vehicles – Trucks (Vehicles – Trucks) Costs of operating assigned and/or pooled FortisBC trucks. Postings are through Accounts Payable.
66103	Equipment – Backhoes Costs of operating backhoes. Postings are through Accounts Payable.
66104	Equipment – Other Costs of operating assigned and/or pooled FortisBC vehicles and equipment not covered by cost elements 66101 or 66102. Postings are through Accounts Payable.
66107	Vehicles – Mini-Equipment Charges for the use of leased mini-equipment. Postings are through Accounts Payable.

66108	Vehicles – Licence Fee Charges for vehicle licensing paid to ICBC and/or other applicable insurer/public body.
66109	Vehicles – Fuel Expense Charges for fuel used in Company vehicles.
66110	Vehicles – Repair & Maintenance Charges for repairs and maintenance to Company vehicles.
66111	Vehicle Lease/Rental Charge Monthly lease charges for vehicles being leased from PHH. Postings are via upload to a journal voucher.
66114	Vehicles – Miscellaneous Charges Any miscellaneous charges related to vehicles that do not fit in the following cost elements: 66108 to 66114
66115	Fleet Management Monthly cross charging from fleet cost centres to cost centres that have vehicles. Postings are via journal voucher.
66116	Vehicle Gain/Loss Gain or loss on disposal units.
66117	Restricted HST - Vehicles This account will be used to capture HST that is not recoverable as an input tax credit arising from charges related to vehicles.

5.13 Contractors

63101	Consulting Fees Management consulting fees, including labour dispute mediation fees, engineering and consulting fees, personnel services, financial process development and review services, etc. Includes CustomerWorks customer care services to the end of 2005 only. Excludes computer consulting costs, which are charged to 68101. Entries are through Accounts Payable.
63116	Customer Care Services This account will be used to allocate the fees charges by CustomerWorks for customer care services (customer contact, billing support, meter services and credit & collections) beginning in 2006 (prior to this included in 63101). Entries are through Accounts Payable.
63122	Consulting – Adjustment Consulting adjustments recorded to VP cost centres in the Co module. Balances in the account should be zero. Entries are through journal voucher.
65202	Contractors – Miscellaneous Cost of contractors (labour only), not covered by any other cost element. Entries are through Accounts Payable.
65203	Contractors – Flagging Cost of contractors hired for flagging and traffic control. Entries are through Accounts Payable.

65204	Contractors – Cartage Cost of contractors hired for cartage, particularly of backfill material. Entries are through Accounts Payable.
65206	Contractors - Installation Cost of gas installation contractors hired for construction, removal and maintenance of gas plant facilities, including primary mains service line contractors. Entries are through Accts Payable.
65207	Contractors – Paving Cost of contractors hired for paving, either directly or through cities and municipalities for permanent repairs to paving disturbed during work on gas plant facilities. Entries are through Accounts Payable.
65208	Contractors – Other Cost of independent contractors that provide both labour and equipment, not covered by any other cost element. Entries are through accounts Payable.
65209	Contractors – Survey Cost of contractors performing survey work. Entries are through accounts Payable.
65227	Pipeline Patrol The costs of pipeline patrol in company 6000. Postings are from Accounts Payable.
65232	Removal Costs Removal costs that were previously capitalized are now being expensed under IFRS reporting. Entries are through recurring JE's only as amount is set per regulatory filing.

5.14 Computers & Technology

68101	Computer – Consulting Consulting fees incurred in connection with the development, operation, maintenance and support of various operational systems. Excludes all non-computer related consulting costs which should be charged to 63101. Entries are through Accounts Payable.
68102	Computer – Outsourcing Computer service charges such as: computer terminals, computer printers, computer terminal transactions, TSO (Time Sharing Option) usage costs and Information Centre costs. Exclude consulting (68101). Entries are through Accounts Payable.
68106	Computer – Software Cost of acquisition and installation of software and upgrades. Entries are through Accounts Payable.
68107	Computer – Hardware Cost of acquisition of computer hardware and accessories. Entries are through Accounts Payable.

5.15 Recoveries

69100	AR Deposits Clearing to Capital Account holds deposits received on the accounts receivable system (GL 14014). This account is credited when the deposits are received; when the job is billed through the AR system, the appropriate recovery cost elements are credited and this account is debited, clearing it to zero (but receipt and application of deposit may not offset in same year). The account settles to capital orders each month-end.
69101	Non-Refundable CIAC Received Includes non-refundable contributions in aid of construction (CIAC), and other non-refundable contributions received towards capital projects. Entries are through posting from AR system or journal entry for cash received.
69102	Recoveries on Damage Claim A/R Includes credits for sundry recoverable work done by or on behalf of FortisBC, and the recovery of accounts written off to bad debts. Not to include contributions in aid of construction. Entries are through posting from AR system or journal entry.
69103	Recoveries – Salvaged Materials Amounts received as recoveries from salvaged materials. Entries are through journal entry for cash received.
69104	Recoveries – Damage Claim Overhead Direct cost of billable work is credited to work in process, overhead recovered is credited to this cost element.
69107	Recoveries – Manufactured Materials to Stock Recoveries of manufactured inventory. Postings are from the materials management system.
69108	Recoveries of O&M Costs Miscellaneous recoveries not covered by another cost element which offset O&M expenses incurred, and are not undertaken with an expectation of profit. Examples are lease recoveries, sales of miscellaneous O&M materials at cost, charges to ABSUI for SAP resources, continuing service fee income, employee gym memberships. Entries are through posting from AR system or journal entry for cash received.
69109	NRB Overhead Recovery (For Finance Use Only) This account creates the cost associated with the recovery of 5% overhead on labour to non-regulated businesses (NRBs) per actual timesheets submitted, per agreement with the BCUC. These amounts are posted through journal entry - offset is GL 57913. Overhead on other labour billed to NRBs through the AR subsystem (GL 14014) is also captured in this account.
69110	NRB Labour Recovery (For Finance Use Only) Direct cost of non-regulated business (NRB) continuing service labour. For pooled contracts, amounts are posted through recurring journal entry at 1/12th of the annual budgeted amounts each month. Other labour is billed through the AR subsystem (GL 14014) to NRBs based on actual time incurred.
69111	Recoveries - Costs Recoveries of work done by the Measurement Technology group from 3rd parties. Entries are from the AR subsystem (GL 14014).
69112	Recoveries - Overheads Recoveries of overhead on work done by the Measurement Technology group from 3rd parties. Entries are from the AR subsystem (GL 14014)

69113	Recoveries – Bad Debts Recoveries of bad debts previously written off for gas sales customers (rates 1, 2, 3). Entries are from the Energy system, posted by ABSU.
69114	Recoveries – Revenue Classified as O&M Miscellaneous revenues not covered by another cost element which are classified as O&M expenses, but are undertaken with an expectation of profit. Examples are reactivation charges, fees charges to marketers, external gas management and admin fees. Entries are through posting from AR system or journal entry for cash received.
69115	Recoveries – Miscellaneous A/R Recoveries of miscellaneous accounts receivable (GL 14014), primarily through collection efforts of Wiggins (collection agency), offset by small write-offs to A/R. Includes recoveries of overheads from third parties. Entries are through journal entry for cash received.
69116	Management Services Income Recoveries of management services, including gas management fees, gas control management fees and IT management fee income including rent, facilities, data line, IT and SAP. Entries are through recurring journal voucher
69121	Recoveries – CIAC Excess Footage Recoveries of Contributions in Aid of Construction (CIAC) related to excess footage. Postings are from the Order Fulfilment system. Account settles to capital at month-end.
69122	Recoveries – CIAC Billable Alterations Recoveries of Contributions in Aid of Construction (CIAC) related to alterations. Postings are from the Order Fulfilment system. Account settles to capital at month-end.
69123	Recoveries – CIAC Main Extensions Recoveries of Contributions in Aid of Construction (CIAC) related to main extensions. Postings are from the Order Fulfilment system. Account settles to capital at month-end.
69124	Recoveries – CIAC Service Line Fees Recoveries of Contributions in Aid of Construction (CIAC) related to main extensions. Postings are from the Order Fulfilment system. Account settles to capital at month-end.
69125	Recoveries – CIAC Additional Meters Recoveries of Contributions in Aid of Construction (CIAC) related to additional meters. Postings are from the Order Fulfilment system. Account settles to capital at month-end.
69126	Recoveries – CIAC Other Recoveries of Contributions in Aid of Construction (CIAC) billed through the AR subsystem (GL 14014). Account settles to capital at month-end.
69127	Recoveries – Application Fee Application service fee revenue of $85 per application received from customers, posted from the Order Fulfilment system. Account settles to 56101 Connection Charges at month-end.
69128	AES Overhead Recovery of regulated amount of $500K to be charged to the Alternative Energy Solutions deferral account.

69129	Biomethane Cost of Service Allocation Recovery of capital related Biomethane cost of service (Earned Return, Income Tax & Depreciation Expense) that are attributable to Biomethane Variance Account (BVA) for the upgrader equipment – GL#18174 – and cost of service associated with the capital costs of assets connecting to the distribution grid (immediately downstream of the upgrader) – GL#18176. The offsetting GL account is 31907 “Biomethane – Other Revenue”.
69700	Overheads Capitalized Credits for overheads allocated to construction as a result of the Overhead Capitalization Policy. Entries are system generated with the offsetting debit to capital at month-end.
69898	Intercompany Cost Allocations This is the offset account for the FICO reconciliation account. It is the replacement for the 1419x accounts. If someone does a posting in CO which crosses company codes then this account is used to post the intercompany entry in FI because the secondary cost elements in CO don't exist in FI. This cost element is also used for the HR recovery between FEVI and FEW – credit in company 6000 and debit in company 6100. Postings are through recurring journal voucher.

5.16 Allowance for Funds Used During Construction (AFUDC)

69200	AFUDC (Allowance for Funds Used During Construction) Cost of capital charged to projects greater than three months in duration, costing at least $50,000. AFUDC is automatically calculated by SAP. Do not charge directly to this cost element.

6. CORPORATE INCOME AND EXPENSE DESCRIPTIONS

6.1 Depreciation and Amortization

30301	Depreciation This account will include the amount of depreciation expense for depreciable plant at the depreciation rates maintained in the asset management system. The offset for these charges is GL 10500 Accumulated Depreciation – Gas Plant. This account will also include the amount of amortization for contributions in aid of construction (CIAC) received (GL. 21101). The offset for these charges is GL 21102 Accumulated Amortization – CIAC. Other amounts charged to this account are the amortization of conversion expenses offset to GL 17520 and the amortization of organization costs offset to GL 17820. This account is credited through journal entry to remove the depreciation of the Lease in Lease Out (LIILO) assets for financial reporting purposes (included in asset management system for regulatory accounting purposes).
30303	Vehicle Lease Depreciation This account will include the amount of depreciation expense for leased vehicles. The offset for these charges is GL 10502 Accumulated Depreciation – Capital Lease vehicles.
30401	Amortization This account will include the amount of amortization expense for plant at the amortization rates maintained in the asset management system. The offset for these charges is GL 10500 Accumulated Depreciation – Gas Plant.
30402	Amortization – Non Plant This account will include the amount of amortization for deferred charges and deferred credits. Significant items amortized to this account include deferred interest, property tax, pension and insurance variances, Coastal Facilities deferral, NGV deferrals, rate hearing costs, marketing rebates. Postings are through recurring journal voucher.
30403	Amortization – Government Loans For company 6000, this account will include the charges arising from the monthly amortization expense of repayable Government loan(s). Amounts are posted through journal entry.

6.2 Property and Other Taxes

30501	Property Taxes This account includes property tax expense levied by various municipalities. This account will be debited with recurring journal entries, accrued on a straight-line basis as 1/12th of the annual budgeted amount to G/L 25625. In June or July of each year, the annual property taxes are paid, and the expense is adjusted to account for any over or under accrual. In company 2000, any variance between actual and budgeted property taxes is deferred to G/L 17915.
30502	Other Taxes For company 1000, this account will include accruals for Ontario taxes payable (offset to 25626).

30503	Motor Fuel Tax Expense For company 6000, this account will include the Motor Fuel Tax paid to the Provincial Government on natural gas consumed by FEVI compressor stations. The offset of this account will be G/L 25114 – Motor Fuel Tax Payable.
30504	SST – Meter Station Fuel For company 6000, this account will include the Social Services Tax paid to the Provincial Government on natural gas consumed by FEVI compressor stations. The offset of this account will be G/L 25111 – SST Payable.

6.3 Interest on Long Term Debt

32000	Interest Expense on Long Term Debt This account will include the amount of interest expense on all classes of long-term debt, the principal of which is included in Account No. 22000 (Long-Term Debt).
32001	Interest Expense on 8.0% Capital Securities This account will include the amount of interest expense on the $125 million 8.0% Capital Securities. This account is being used since February 2005 as the expense was previously charged to G/L 35705 – Dividends on 8.0% Capital Securities. The offset to this account is 25303 – Dividends Payable – 8.0% Capital Securities.
32002	Swap Interest Expense This account captures the net interest expense on interest rate swaps outstanding. The offset to this account is 25703 – Swap Interest Receivable.
32003	Interest Income – Interco PMM C D This account will include the amount of interest income on Series C and Series D Debentures with the status of Purchase Money Mortgages (PPM), between FortisBC Energy Inc. and Inland Energy Corporation. The Series C Debenture has a book value of $75,000,000, bears interest at 9.75% and is due September 30, 2037. The Series D Debenture has a book value of $75,000,000, bears interest at 10.52% and is due September 30, 2038. The Debentures are included in Account 22000 (Long-Term Debt).
32004	Interest Expense – Interco PMM C D This account will include the amount of interest expense on Series C and Series D Debentures with the status of Purchase Money Mortgages (PPM), between FortisBC Energy Inc. and Inland Energy Corporation. The Series C Debenture has a book value of $75,000,000, bears interest at 9.75% and is due September 30, 2037. The Series D Debenture has a book value of $75,000,000, bears interest at 10.52% and is due September 30, 2038. The Debentures are included in Account 22000 (Long-Term Debt).
32005	Long Term Interest – Fortis Inc. This account will include interest expense on long-term payable to Fortis Inc.
32101	Amortization Debt Discount, Premium and Expense This account will be charged or credited during each fiscal period with the proportion of the discount, premium, and expense on long-term debt obligations applicable to that period. The amount charged each period will reduce the unamortized balance to zero over the term of the individual debt (see account 18001).

32203	Interest on Class B Subordinated Debt This account will be used to record the interest incurred on FEVI's subordinate debt to FortisBC Holdings Inc. as part of the acquisition agreement to convert Westcoast Energy Inc.'s Preferred Shares series A into debt. The interest on this debt was set at conversion and is subjected to reset. As a surplus is available, debt is drawn down based on whichever series is closest to coming due for reset at time of pay down. The offset of this account is G/L 22002 – FEVI Subordinated Debt.

6.4 Short Term Interest Expense

32301	Short Term Interest on Bank Debt This account will include the amount of interest expense on all bank loans, the principal of which is included in Account No. 25002 (Bank Loans).
32302	Short Term Interest on Commercial Paper This account will include the amount of interest expense on short-term notes and commercial paper issued by the Company maturing in one year or less, the principal of which is included in Account No. 25001 (Commercial Paper and Other Notes Payable). Entries are through the Treasury system.
32303	Other Interest Expense This account will include all short-term interest expense not provided for elsewhere, such as security deposit interest, bank interest and bank service charges, less interest income on LILO lease payments receivable 12513.
32305	Interest on MCRA, CCRA and Gas in Storage This account records the interest income or expense on the excess of the allowable debit or credit balance on the MCRA, CCRA and Gas in Storage (17926, 18137 and 18533) deferral accounts as allowed by the BCUC.
32306	Foreign Exchange Gain/(Loss) This account contains the foreign exchange gain or loss that results from holding US dollar denominated assets and liabilities. The SAP system runs a program each month end that revalues the US denominated amounts into CDN; and posts the difference into this account; the entry is reversed in the following month. In addition, journal entries are posted here to manually convert amounts from US to CDN.
32307	Cash Discount Taken Income from cash discounts taken by paying Accounts Payable invoices per the cash discount terms of the vendor. Postings are from Accounts Payable.
32308	Interest Income – FortisBC Energy (Vancouver Island) Inc. Interest income in company 1000 from FortisBC Energy (Vancouver Island) Inc., on the intercompany debt between the two companies.
32309	Interest on RSAM This account will include interest calculated on the difference between the actual and forecast mid-month average balance of the deferral account RSAM G/L 17927, multiplied by the composite interest rate based on short term debt & investments as authorized by the BCUC Order G-07-03 for FEI and G-138-10 for FEW.
32310	Other Financing Costs This account will include the costs incurred for the ESP transfer agent & registrar fees paid to CIBC Mellon Trust.

32312	Deferred Interest – FortisBC Energy (Whistler) Inc. This account will be used to record the FEW dollar difference between the actual cost of short term debt and the long term debt rates that have been included in the application. Offset is to 18124.
32314	Interest on Goodwill This account will include the calculation of current portion of interest expense applicable to Goodwill on FEVI, a non-rate based item. This is a reclassification only, as the offset is in 32303.
32315	Non Regulatory Interest In FEVI, used to record non-regulatory interest, including stand by fees.
32317	Commissions & Backstopping Fees This account will include the amount of commission expense and backstopping fees on short-term notes and commercial paper issued by the Company maturing in one year or less, the principal of which is included in Account No. 25001 (Commercial Paper and Other Notes Payable). Entries are through the Treasury system.
32318	Vehicle Lease Interest This account will include all short-term interest expense on leased vehicles.
32319	Short Term Interest - Fortis This account will include all short-term interest expense from Fortis loans.

6.5 Interest Capitalized

32400	AFUDC Equity Portion This account is used to capture the Allowance for Funds Used During Construction (AFUDC) that relates to equity. AFUDC is calculated on all Gas Plant Under Construction, where the individual project is greater than $50,000 and longer than 3 months. This account is credited and the project is debited.
32401	Interest Capitalized Equity Portion In FEVI, this account is used to capture the interest capitalized on deferral accounts (equity portion).
32500	AFUDC Debt Portion This account is used to capture the Allowance for Funds Used During Construction (AFUDC) that relates to debt. AFUDC is calculated on all Gas Plant Under Construction, where the individual project is greater than $50,000 and longer than 3 months. This account is credited and the project is debited.
32501	Interest Capitalized Debt Portion In FEVI, this account is used to capture the interest capitalized on deferral accounts (debt portion).

6.6 Income Taxes

30601	Current Income Taxes This account will include provision for federal, provincial or other government current income taxes based on the company's income or loss for the fiscal period. Current income tax expense is accrued each month through journal voucher; the annual provision is reviewed and adjusted as appropriate by the tax department. When income tax returns are finalized in the following year, the provision is adjusted to reflect actual taxes payable or receivable.
30602	Future Income Taxes This account will include the timing differences between income tax expense recorded for accounting purposes and income tax as reported on the tax returns. Currently, the regulated entities in the FortisBC group use the income taxes payable basis, and therefore do not calculate future income tax expense.
30603	Current Income Taxes – NREG This account will include provision for federal, provincial or other government current income taxes based on the company's non-regulated income or loss for the fiscal period. Current non-regulated income tax expense is accrued each month through journal voucher; the annual provision is reviewed and adjusted as appropriate by the tax department. When income tax returns are finalized in the following year, the provision is adjusted to reflect actual taxes payable or receivable.

6.7 Income from Affiliates

31501	Dividend Income – Inland Energy Corp. This account will include dividend income recorded at the date dividends are declared by Inland Energy Corp. (company 5000).
31502	Dividend Income – FortisBC Holdings Inc. This account will include dividend income recorded at the date dividends are declared by FortisBC Holdings Inc. (company 1000).
31504	Dividend Income – FortisBC Energy Inc. This account will include dividend income recorded at the date dividends are declared by FortisBC Energy Inc. (company 2000).
31505	Dividend Income – IPPDA LLC This account will include dividend income recorded at the date dividends are declared by IPPDA LLC.
31506	Dividend Income – Other This account will include dividend income recorded at the date dividends are declared by any company for which there is not a specific dividend income account.
31507	Dividend Income – FortisBC Gas Holdings Inc. This account will include dividend income recorded at the date dividends are declared by FortisBC Holdings Inc. (company 1021).
31508	Dividend Income – 0849218 BC ULC This account will include dividend income recorded at the date dividends are declared by 0849218 BC ULC. (company 2010).
31509	Preferred Dividend Income – FortisBC Energy (Vancouver Island) Inc. This account will include dividend income recorded at the date dividends are declared by FortisBC Energy (Vancouver Island) Inc. (company 6000).

31510	Interest Income (FEVI Subordinated Debentures) This account includes the interest income in company 1000 on the subordinated debentures it holds in company 6000. The interest income and expense (account 32203) are recorded each month through journal voucher.
31513	Interest Income - TES This account consists of interest income earned by company 1000 on advances to company 7000.
31602	Interest Income – FortisBC Huntingdon Inc. This account will include intercompany interest income on advances and loans to FortisBC Huntingdon Inc. (company 4000).
31604	Interest Income – Intercompany This account will include intercompany interest income on advances and loans to companies within the FortisBC group, where those amounts are not tracked in a separate G/L.
31606	Equity Pickup – CustomerWorks LP This account will include the company's share of income or loss from CustomerWorks LP, recorded on an equity accounting basis.
31705	Intercompany Lease Income This account includes the lease income from leases with other companies within the FortisBC Group. Example would be the SCP lease income.
31706	Partnership Income This account will include the company's share of partnership income.

Attachment 24.1

REFER TO LIVE SPREADSHEET

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Attachment 34.1

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Attachment 45.1

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Attachment 46.1

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Attachment 54.1

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Attachment 63.1

FILED CONFIDENTIALLY

Attachment 64.1

Regarding the OGAA Implementation: All necessary regulations, documents and background information on OGAA can be found at www.ogc.gov.bc.ca/OGAA/
For any questions pertaining to the status of this document, please contact the Commission at (250) 261-5700.

August 25, 2006 **INFORMATION LETTER #OGC 06-12**

SUBJECT: **Adoption of CAN/CSA Z662-03 Oil and Gas Pipeline System Annex N Guideline for Integrity Management Programs.**

TO: All Stakeholders

In June 2005, the Canadian Standards Association (CSA) published *Supplement No. 1* to *CSA Standard Z662-03: Oil and Gas Pipeline Systems.* The supplement contained the new *Annex M: Sour Service Pipelines* and *Annex N: Guidelines for Pipeline Integrity Management Programs (ANNEX N)*. Annex N provides an approach for ensuring that pipelines are capable of transporting product safely, without short-term or long-term negative effects on public safety or the environment.

The Oil and Gas Commission (OGC) proposed to make Annex N mandatory and requested stakeholder comment by means of Information Letter #OGC 06-08*: Canadian Standards association Can/CSA Z662-03 "Oil and Gas Pipeline Systems, Annex M and N Supplement No. 1*, which was posted in April 2006 on the OGC Web site for stakeholder comment. The OGC considered all comments received.

Information Letter # OGC 06-08 noted that CSA Z662-03, Annex M, is mandatory for sour service pipelines. Pipeline integrity management programs are included within Annex M, and therefore licensees are required to develop and implement an integrity management program for sour service pipelines regardless of the overall adoption of Annex N for other types of pipeline.

Requirement

In accordance with Section 10 of the Pipeline Regulation the OGC has adopted Annex N as a revision to CAN/CSA Z662-03. Owners or operators of pipelines must develop and implement an integrity management program in accordance with CSA Z662-03, Annex N.
As oil and gas companies may require time to meet this requirement, licensees must

• by **March 1, 2007**, develop an integrity management program (Clauses N.1 to N.9), and

• by **September 1, 2007**, develop hazard identification and controls, risk assessments, and program planning (Clauses N.10 to N.17).

…/2

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Noncompliance

After the specified dates, non-compliance with the requirements of Annex N could result in an enforcement action.

If you have any questions regarding Annex N, please contact:

Richard Caesar
Senior Pipeline Integrity Management Specialist
OGC Technical Services and Regulatory Affairs Branch
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Victoria, BC V8W 9N3
Phone: (250) 356-2903.
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Email: Richard.Caesar@gov.bc.ca

Original Signed By: Ross Curtis

Ross Curtis
Commissioner

Attachment 78.1

THERMAL ENERGY SOLUTIONS

2012 ALLOCATED COSTS

		2012 Estimates	2012 Estimates
	Totals	497,377.44	497,377.44
ALLOCATION OF OVERHEADS FOR THERMAL ENERGY SOLUTIONS		SUBTOTAL ($)	TOTAL ($)
AREA	SERVICES TO AES		
Executives	President & CEO	4,220.00	
	EVP, Finance	8,440.00	
	VP Finance & CFO	8,440.00	
	VP Energy Solutions & External Relations	34,815.00	$ 55,915.00
Finance	Accounts Payable	618.72	
		1,167.84	
		537.00	
		241.86	$ 2,565.42
	Operations Financial Analyst/Co-ord	2,474.88	$ 2,474.88
FortisBC Holdings Inc.	Financial Reporting (Carrie Mah)	34,155.00	$ 34,155.00
Regulatory Affairs	Cost of Service group	33,618.75	
	Tariffs & Rate Design group	33,412.50	
	Project Management group	51,150.00	$ 118,181.25
Human Resources	Recruiting related	1,800.00	
	Compensation & Benefits	9,045.14	$ 10,845.14
Information Technology	IT management costs	51,571.85	$ 51,571.85
Facilities	Surrey Facilities costs	63,269.99	
	Garbally Facilities costs	47,910.00	
	Burnaby Facilities costs	110,488.92	$ 221,668.91

THERMAL ENERGY SOLUTIONS

2013 ALLOCATED COSTS

		2013 Estimates	2013 Estimates
	Totals	**511,685.86**	**511,685.86**
ALLOCATION OF OVERHEADS FOR THERMAL ENERGY SOLUTIONS		**SUBTOTAL ($)**	**TOTAL ($)**
AREA	SERVICES TO AES		
Executives	President & CEO	4,380.00	
	EVP, Finance	8,760.00	
	VP Finance & CFO	8,760.00	
	VP Energy Solutions & External Relations	36,135.00	$ 58,035.00
Finance	Accounts Payable	642.72	
		1,212.96	
		557.76	
		251.28	$ 2,664.72
	Operations Financial Analyst/Co-ord	2,570.88	$ 2,570.88
FortisBC Holdings Inc.	Financial Reporting (Carrie Mah)	35,145.00	$ 35,145.00
Regulatory Affairs	Cost of Service group	34,856.25	
	Tariffs & Rate Design group	34,650.00	
	Project Management group	52,937.50	$ 122,443.75
Human Resources	Recruiting related	1,880.00	
	Compensation & Benefits	9,400.02	$ 11,280.02
Information Technology	IT management costs	51,227.52	$ 51,227.52
Facilities	Surrey Facilities costs	65,168.09	
	Garbally Facilities costs	49,347.30	
	Burnaby Facilities costs	113,803.59	$ 228,318.97

Attachment 85.1

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Attachment 99.1

INTRODUCTION

1.1 Contents of the Manual

Chapter 1: Introduction

Overview of contents, purpose and audience

Chapter 2: Capitalization Policy

Outlines the minimum capitalization level and policy issues by category

Chapter 3: Capital Expenditures Control

Describes the Approval Levels and the policies related to controlling capital expenditures

Chapter 4: Plant In Service and Retirements

Outlines the policies related to custody, care, transfers and retirements of capital assets

Chapter 5: Depreciation

Describes the depreciation process for various types of assets

1.2 Purpose of the Manual

This manual has been prepared to provide guidelines for accounting and field personnel, and to document accounting standards at Terasen Gas. Use this manual to:

- determine which expenditures can be capitalized and which should be expensed
- learn about capitalization policies related to plant additions, transfers and retirements; including the application of overhead, allowance for funds used during construction and depreciation
- ensure that capitalized expenditures are appropriately authorized, recorded and controlled
- describe the administration in caring for and maintaining custody and control over the Company's capital assets
- identify the accounting classification of gas plant in service, work in progress and other gas plant
- follow prescribed procedures to help you with the process of capital expenditure control and to maintain adherence to capitalization policies

1.3 Audience for the Manual

This manual should be read and complied with by all Company personnel who are involved in the construction, acquisition, maintenance, removal and disposal of capital assets.

CAPITALIZATION POLICY

2.1 Introduction

This chapter covers the capitalization policies related to the capital additions acquired or constructed, defining capital versus maintenance expenditures, the basis of capital costs, and the classification for certain types of capital expenditures.

Matching Costs

Terasen Gas policy is to distribute expenditures as equitably as possible among present and future customers by matching capitalized costs to the accounting period in which associated benefits accrue. This is accomplished in accordance with the Company's depreciation/amortization practices, which are subject to BCUC regulations.

Capitalization

All costs associated with the acquisition and construction of capital assets are capitalized.

Capital Asset

Expenditures are classified as a capital asset following these criteria:

- the expenditure must provide, or contribute, benefits to Terasen Gas for a service life greater than one year
- the expenditure must result in, or contribute toward, acquisition of an economic resource or asset over which Terasen Gas has a legally enforceable claim to a service potential, right or specific benefit. Terasen Gas must also control the asset
- the expenditure must be expected to result in, or contribute toward, a benefit which leads with a reasonable degree of certainty to recover through potential sales of service or products, or which is required to meet safety or governmental regulations
- the expenditure must meet the minimum capitalization level requirements

2.2 Minimum Capitalization Level

Minimum Level

For direct costs incurred in acquiring or constructing the addition or replacement of a PRU which falls into one of the categories, is capitalized if the cost of the PRU exceed the specified limits:

	Minimum $
Tools and equipment	1,000
Furniture and equipment	1,000

Purchased computer software/hardware	1,000
Other general plant equipment	1,000
In-house developed computer software and/or based on assessment of individual projects	10,000

Concept of PRUs

The concept of Property Retirement Units (PRUs) is defined in the Company's PRU Catalogue. The PRU Catalogue is an integral part of the Capitalization Policy.

2.3 Capital Versus Maintenance

PRU Additions

The PRU outlines/describes the lowest level of expenditure for capitalization purposes for a unit of property in the asset subledger.

Maintenance

Items smaller than a component outlined/described in the PRU or an item whose acquisition cost is lower than the minimum capitalization level is charged to maintenance.

Expenditure on Existing PRUs

Expenditure on existing PRUs in service are capitalized if the expense results in:

- a replacement of the entire PRU or
- a substantial improvement or betterment of the PRU

Classification of Expenses

Expenditures during ownership of capital assets are classified as:

- maintenance and repairs
- improvements and additions
- rehabilitation/major renewals
- replacements and retirements

these expenditures are defined in further detail below to set them apart and to distinguish the cost as capital or a maintenance charge.

2.3.1 Maintenance and Repairs

Concept

Maintenance costs are expenditures made to keep the asset in good condition (preventive); while repair costs are made to put the asset back into good working condition (curative).

Does not Affect

Maintenance and repair costs are not expected to prolong the normal life of an asset (PRU), or materially add to its service value. As no additional benefits are anticipated, the costs of maintenance and repairs are charged to maintenance in the current accounting period.

2.3.2 Improvements and Additions

Substantial Betterments

Improvements or substantial betterments refer to capital expenditures on existing PRUs which:

- materially add to the service value of the PRU(s); or
- materially extend the normal service life of the PRU(s)

Increase in Service Value

The service value of a PRU may be increased through expansion and extension where there is an increase in the physical size of an asset. For example, a new wing is added to a building or more equipment is added to an existing capital asset.

Increase in Service Life

The normal service life of a PRU is increased through substitution where there is an increase in the quality of an asset. For example, paving a gravel parking lot increases the quality of an existing asset.

Consult Asset Accounting

When in doubt about each case in Section 2.3, consult Asset Accounting to assist you in deciding the appropriate accounting treatment.

Significant cost and long life do not by themselves decide that a replacement cost can be capitalized; e.g. the cost to replace a roof with the same kind of materials is accounted for a maintenance expense.

2.3.3 Rehabilitation/Major Renewals

To Restore

Expenditures to restore or improve buildings or equipment purchased in a rundown condition (e.g. second-hand plant), with the intention of rebuilding, can be charged to capital assets as part of the cost of acquisition, provided that;

- the costs of renewals, which means the costs of material (other than excluding second-hand parts remaining in the rebuilt PRU), plus the cost of labour used in the rebuilding process, exceeds fifty percent (50%) of the replacement cost of a new plant unit of the same kind and class
- the costs of dismantling and/or repairing old parts reused, are excluded and charged to expense

- the rebuilt plant unit (PRU) is accounted for as a capital addition, and the old plant unit PRU is accounted for as retired from service

2.3.4 Replacements and Retirements

Complete PRU

Replacement of a complete PRU:

- the original cost of the old asset (PRU) is retired and the cost of the new item is capitalized

Part of PRU is Maintenance

Replacements of parts and (less than a PRU):

- the costs of replacing parts and components of a PRU is accounted for as maintenance expense. Replacements of parts and components here means to restore the PRU to its original condition, and keep it in efficient operating condition

Extensive Replacement

Extensive replacements of part (less than a PRU) could be considered as capital improvement/substantial betterment.

The cost incurred to replace components or part of a PRU, which according to government or agency regulation creates a health or safety hazard, does not automatically qualify for capitalization. Such projects must meet the 'substantial betterment' criteria on an individual PRU, project/location basis.

In each case, please consult Asset Accounting.

2.4 Basis of Cost

At Cost

Expenditure for capital assets are recorded at the historic cost to Terasen Gas. Cost includes direct expenditures related to the acquisition/construction as well as a proportionate allocation of overhead and, where applicable, allowance for funds used during construction charges.

Construction by Terasen Gas

- If the capital asset is constructed for or by Terasen Gas, the construction costs including labour, material and supplies, contract work, special machine and heavy work equipment service, insurance, normal levels of damages, privileges, a proportionate allocation for overhead, and where applicable, allowance for funds used during construction.
- When a project necessitates the purchase of PRU equipment items such as office equipment, heavy work equipment, transportation equipment to be used exclusively for the project, the cost of such equipment is, for the

duration of the project, charged to construction, subject to approval by Asset Accounting.

Surplus-to-Project Material

- When a project is completed, surplus inventory items, considered re-usable, are returned to stores by crediting the project at the prevailing inventory unit cost.
- Non-inventory items that can be identified:
  - for future project use, scheduled to begin with two years are taken into Central Stores by crediting the project at fair market value; or
  - as office, heavy work or transportation equipment which were initially purchased exclusively for project use and now considered re-usable as general plant equipment, are transferred from WIP account to plant-in-service at fair market value, provided it meets the minimum capitalization level. If it is not considered re-usable as general plant equipment, it must be disposed of through re-sale and the proceeds credited to the project.

2.5 Capitalized Overhead

Cost Classification

Costs which cannot be directly identified with individual construction projects are collected by a cost centre and classified as operating /maintenance expense or capitalized overhead.

Allocation Predetermined

Overhead will be capitalized on the basis of predetermined rates established by Finance and reviewed annually, to ensure that the apportionment of Operating and Maintenance expense to capitalized overhead is reasonable and consistent.

Capitalization rates will be calculated annually by Finance, based initially on budgeted costs with revision at year end, to actual costs where the change is considered to be material.

Certain administrative/common costs are capitalized at fixed maximum rates, which do not vary with construction levels and will not be recalculated annually.

Distributed to Plant

The resultant overheads capitalized are charged monthly to GL account 10098 (Overhead Charged to Construction).

Plant Not Applicable

Overhead is NOT applied to:

- removal/dismantling costs
- general plant capital additions
- 47810 Meters
- CPCN projects

2.6 Allowance for Funds Used During Construction (AFUDC)

Policy

AFUDC is capitalized on projects under construction whose costs are greater than $50,000 each and which are expected to take three (3) or more months to construct. AFUDC is the cost of capital that is the cost of borrowed funds and a reasonable rate on other funds such as equity, used for the purpose of construction.

Rate Determined

The AFUDC rate is the return on rate base for Terasen Gas as approved by the BCUC.

AFUDC Applied

AFUDC is applied to both specific and certain recurring plant expenditures based on previous month-to-date total direct and overhead costs, less contributions in aid of construction received, if any.

AFUDC Begins

AFUDC will commence on the date the project work commences and ends when the project is placed into service For further information, refer to AFUDC documentation.

Preliminary Charges

Refer to section 2.8.2 below.

Adjustment

AFUDC applied to specific projects, may be subject to recalculation or reversal, if the AFUDC criteria is not met or the AFUDC rate is adjusted.

AFUDC Not Applied

AFUDC is not applied on expenditures in the following capital asset classifications:

- capital assets in service
- capital assets held for future use
- capital assets held for resale
- research, development and preliminary engineering
- projects with budgeted costs less than $50,000

- projects which are expected to be completed in less than three (3) months

2.7 Contribution In Aid of Construction

Source of

Consists of contributions or grants in cash, service or property from governments or government agencies, corporations, individuals and others for contributions in aid of construction and other purposes.

Refundable Contribution

Customers' Advance for Construction, G/L Account 25501 is reviewed at least annually by Finance, and any balance remaining by customer according to agreement or rule, shall be reclassified to contribution in aid of construction

Accounted for

The gross costs of the capital asset constructed is charged to the appropriate Gas Plant in Service account with a contra 21101 account to offset, the contribution in aid of construction.

From Billable Work

Recoverable costs, from billable work capitalized as capital additions, are accounted for as a contribution in aid of construction.

2.8 Classification of Capital Expenditures

Reason for

Certain types of expenditures warrants explanations in respect of capitalization policy, because of their function purpose and unique characteristics they are:

- computer software
- land
- leased property
- leasehold improvements
- pipeline – relocations and replacements
- major inspections and overhauls
- spare parts
- gas plant held for future use
- gas plant not in rate base
- deferred projects
- abandoned projects
- property taxes

Each of these are described below.

2.8.1 Computer Software

Purchased

Purchased computer software is capitalized according to the minimum capitalization level; See Capitalization Policy, Minimum Capitalization Level, Section 2.2.

In-House

The cost of in-house developed software will be considered for capitalization in accordance with the Capitalization Policy, Minimum Capitalization Level, Section 2.2.

- or based on an assessment of the individual project, it will include the cost of designing programs and implementing the system

2.8.1.1 Costs excluded from capitalization

Costs that are no longer capitalized and should be expensed include:

- development of training materials
- data conversion
- user training costs and
- feasibility costs

Enhancements

Subsequent enhancements are capitalized if:

- it meets the Improvement and Additions Criteria referred to under Section 2.3.2, and
- it meets the same minimum capitalization level set for in-house developed software

2.8.2 Land

Temporary Accounts

The cost of land is capitalized to plant and classified in one of the following accounts until it is placed in service:

- gas plant held for future use – when purchased with no immediate use
- work-in-progress – when purchased directly for, or transferred in from gas plant held

Cost Excluded

The costs of clearing, grading, leveling and surveying both before and after the construction are to be included in the cost of constructing the plant facilities and, therefore, are not to be included in the cost of the land.

Not-In-Service, Resale

Land that is not-in-service or removed from in-service for resale, is classified as Gas Plant Not In Rate Base; until sold

2.8.3 Leased Property

Capitalization Criteria

Leases are capitalized if the terms of the lease transfer substantially all of the benefits and risks of ownership related to the property from the lessor to Terasen Gas (lessee). There are no restrictions on the term of capitalized leases.

Transfer of Ownership

Ownership passes to Terasen Gas at the inception of the lease provided one or more of the following conditions are present:

Time of Transfer

- the terms of the lease provide that ownership of the leased property passes to Terasen Gas by the end of the lease term, or the lease provides for a bargain purchase option minimum $500 per PRU

Receive Economic Benefits

- the lease term is of such a duration that Terasen Gas will receive substantially all the economic benefits expected to be derived from the use of the leased property over its useful life (when lease term exceeds 75% of useful life)

Returns Assured

- the lessor would be assured of recovering the investment in the leased property and of earning a return on the investment as a result of the lease agreement

Leases Less Than $10,000

- for leases with payments over the term totaling less than $10,000 and where the asset is acquired at the end of the agreement or on buyout, the asset is recorded at the time of transfer of title to Terasen Gas

2.8.4 Leasehold Improvements

Criteria

A leasehold improvement exists when Terasen Gas leases property and incurs costs to make the property suitable for its use; e.g. offices, warehouses.

Capitalized When

Leasehold improvements are capitalized to the extent that:

- they exceed the owner's allowance by $500; and
- they provide benefits to Terasen Gas; and
- the term of the lease is in excess of 12 months

Types of Expenditures

Leasehold improvements

- office renovations to walls, floors and ceilings
- items permanently affixed to the structure
- non-salvageable, e.g. communication cables

Amortized

Leasehold improvements are amortized over the life of the lease and retired from plant in service when the facility is vacated.

2.8.5 Pipeline Relocations and Replacements

Pipe Relocations

Where a transmission or distribution pipeline of 20 or more continuous meters (65 feet) in length is relocated, that section changed is considered capital. The new line is a capital addition and charged to the appropriate capital asset. Where such a relocation results from action by a governmental authority, it will be accounted for in a similar manner.

Pipe Replacements

Where a transmission or distribution pipeline of 20 or more continuous meters (65 feet) in length is replaced for any reason, the original cost of the section removed is treated as a retirement and the total cost of opening and back filling the trench, as well as the installed cost of the new pipe is capitalized

Pipe Removed

A retirement entry is to be made for pipeline removed and/or abandoned due to a relocation or replacement. The costs of removing the retired pipe from the trench are accounted for as removal/dismantling costs.

Service Line Pipe

The costs of extending or shortening an existing service line is defined as an alteration and therefore capitalized. No retirement entry is made until the entire service line is removed or abandoned. Note however, that changes in as-built length must be updated accordingly.

Reconditioning

The costs of reconditioning pipeline not removed are charged to maintenance.

2.8.6 Spare Parts

Charged to Maintenance

Terasen Gas maintains an inventory of spare parts for its gas utility system. Spare parts generally are items comprised of less than a PRU and are, therefore, charged to inventory when purchased and expensed to maintenance when issued.

Types of Parts

Some spare parts, however constitute Retirement PRUs such as:

- spare modules for gas meters
- spare telemetry circuit boards

and are capitalized upon purchase and depreciated over the same estimated service life as the PRU to which they are related.

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2.8.7 Major Inspections and Major Overhauls

Major Inspections: are those considered to be undertaken to assess transmission or distribution infrastructure or other major asset infrastructure or equipment, for possible required capital improvements (including, but not limited to, all ILI) and thus should be capitalized and depreciated separately over the appropriate useful life to the next inspection rather than being expensed. The specific circumstances and facts pertaining to each type of inspection need to be considered. Some possible indicators that can assist in identifying additional major inspections could include consideration of the following (this is not an exhaustive list):

- Cost greater than $250,000, or
- Frequency greater than 1 year (eg. occurs once every 5 years), or
- Required by law or regulations as part of the safe operation of the related asset

The following types of inspections are considered to be "major inspections" as of the date of this memo and should be capitalized as a separate asset:

- In-Line Inspections (includes marine ILI)
- Marine Crossing Inspections (external)

Major overhauls may be required at regular intervals over the useful life of an item of property, plant and equipment, such as the compressor station equipment, to allow the continued use of the asset. The overhaul costs should be capitalized and depreciated separately over the appropriate useful life to the next overhaul rather than being expensed. The specific circumstances and facts pertaining to each type of overhaul need to be considered. Some possible indicators that can assist in identifying additional major overhauls could include consideration of the following (this is not an exhaustive list):

- Cost greater than $250,000
- Frequency greater than 1 year (eg. occurs once every 5 years)
- Required by law or regulations as part of the safe operation of the related asset

The following types of overhauls are considered to be "major overhauls" as of the date of this policy and should be capitalized as a separate asset:

- Gas Turbine Overhauls
- Gas Compressor Overhauls

Intangible Assets

Non-Physical

Expenditure which results in the acquisition of intangible (non-physical) assets, are capitalized provided that:

Provision

- the privileges obtained runs in perpetuity or for a specified term of more than one year; or
- the expenditure is necessary or valuable in the operation of the company and
- the expenditure are in excess of $10,000

Type of Expenditures

Types of tangible asset expenditures are:

- franchises and consents paid to governmental authorities
- patents, licenses, rights and privileges

2.9 Gas Plant Held for Future Use

How to Maintain

The costs of acquiring or constructing plant items for future use are capitalized and classified as Gas Plant Held for Future Use. This account should be maintained in such detail as though the plant were in service.

Qualification Criteria

In order to qualify as Gas Plant Held for Future Use, the plant item must be:

- a physical asset, at a minimum of $500 each
- not in-service or part of unfinished construction
- intended for a specific potential use within 20 years

Held for Resale

If the project is terminated and no other future use is planned, the physical plant items are held for resale at the lower of cost or market value and the gain or loss included in the other income accounts.

2.10 Gas Plant Not in Rate Base

Established By Regulation

Terasen Gas may acquire or construct plant items which are useful and beneficial to the company, but, according to BCUC regulations, are not to be included in the rate base. Such costs are capitalized but classified as Gas Plan NOT in Rate Base.

Detailed Records

Terasen Gas will maintain subsidiary records in which Gas Plant Not in Rate Base is subdivided according to the plant facility to which it applied and to each group of plant accounts.

Type of Expenditures

Gas Plant Not in Rate Base may include the following Capital expenditures:

- BCUC disallowances on cost capitalized in prior years
- corporate art
- premium costs paid on acquisition of other gas utilities, whose plant costs are to be involved in rate base

Disposition

The disposition of Gas Plant Not in Rate Base is reflected on the Income Statement as other income or other income deductions. Refer to Chapter 4, Gas Plant In Service, Section 4.4.3, for policy on premium cost retirements.

Deferred Projects

Criteria

A project is deferred if the scheduled in-service or turn-on date has been delayed by management decisions and the work is halted for more than one year.

Write-Offs

Appropriate write-offs may be made at the time of the deferral and in subsequent reviews where:

- specific obsolescence of some costs is identified; or
- changes in technology or environmental considerations may progressively diminish the usefulness and degree of certainty of recovery

Treatment of Assets Retained

Assets retained at the site may have to be mothballed. Costs of mothballing and maintenance costs during the deferral period as well as demothballing costs are all charged against operations when incurred, since no betterment of the asset has occurred.

2.11 Abandoned Projects

Written-Off

A capital project is considered abandoned when it is decided never to reactivate it again. The costs incurred to date, exclusive of AFUDC and physical assets remaining, are written-off as charges to operations, or if significant, to other income deductions.

Accounting For Physical Assets

Physical assets relating to abandoned projects are either:

- disposed of by resale
- returned to inventory
- transferred to other projects at market value, except where no market value exists in which case original costs will be used; or
- written-off if they have no alternative use or market value

2.12 Property Taxes

Paid on Assets

Terasen Gas pays property taxes, grants or percentage amount in lieu of general taxes on its assessable capital assets while they are in-service or held for future use.

Capitalized When

Taxes on capital assets under construction or on capital assets that are not yet ready for service are capitalized and charged to the appropriate work order or capital account.

Reporting Quantity Data

Operations managers will be responsible to report as required the quantitative data by capital district for Recurring Plant to Lands Department. This data is used to compute the assessable capital assets for property tax purposes.

Reporting Capital Data

Asset Accounting is responsible to accumulate and report capital additions and retirements of assessable capital assets to the Taxation department.

CAPITAL EXPENDITURE CONTROL

3.1 Introduction

This chapter covers the policies related to controlling capital expenditures during the capital acquisition or construction stage.

3.2 Authorization Of Capital Expenditures

Specific Approval Levels

Terasen Gas has established specific authority levels for approving Capital and Operating Expenditures as defined in the Company's Expenditure Authority Policy.

Budgeted vs. Non-Budgeted Items

These levels cover both budgeted and non-budgeted items. Approval authority for budgeted items may be delegated to immediate subordinates. Delegation is not allowed for non-budgeted items.

Types of Cost Monitoring Objects

The following types of objects are used to ensure that Capital expenditures are controlled:

- Internal Orders (I/O)
- Projects and Work Breakdown Structures (WBS)

Recurring and Specific Plant

The use of these objects warrants explanation with respect to the Capitalization Policy, because the capitalization of costs are classified between Recurring and Specific Plant; and variation in level of control is recognized.

Field Operations Responsibility

Recurring Plant expenditures are budgeted for and monitored by Operations.

3.3 Internal Orders (I/O)

Definition

Internal Orders are temporary cost objects used to track one-time events or recurring programs.

Types of Capital Internal Orders

- The types of Capital Orders are listed in the Budget Guidelines Manual, Section 7.1 Capital Expenditures. General Plant direct purchases
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Internal Order Creation

It is the responsibility of each operating department to create internal orders to capture and monitor costs. Costs can be planned in the internal order for comparison between actual and plan. It is important that all mandatory fields are completed accurately and detailed descriptions are maintained so proper settlement rules can be completed.

Settlement Rule

Asset Accounting will enter settlement rules in the orders based on the information entered in the master data of the internal order record. The settlement rule specifies which asset will receive the costs collected in the internal order. Once the asset receives the costs, the asset goes in service.

Internal Order Status

There are four different statuses for an internal order, each allows for different processes to occur. In the created status planning and settlement rule maintenance is allowed. In the released status additional planning, settlement rule maintenance, actual cost posting and settlement to AUC is allowed. When the status is changed to technically complete (TECO) settlement rule maintenance, actual cost posting and final settlement is allowed. The order status is moved to close when all costs are processed and costs are moved to the final asset.

Additional Information

For additional information regarding the use of internal orders, please refer to the Budget Guidelines.

3.4 Projects and Work Breakdown Structures (WBS)

Definition

Projects and WBS Elements are temporary cost objects used to track one-time events or specific programs.

Project and WBS Creation

It is the responsibility of each project manager and or OFA/OFC with the assistance of Asset Accounting to create project definitions and WBS elements to capture and monitor costs. Costs can be planned in the WBS element for comparison between actual and plan. It is important that all mandatory fields are completed accurately and detailed descriptions are maintained so proper settlement rules can be completed.

Settlement Rule

The settlement rule specifies which asset will receive the costs collected in the WBS element. Once the asset receives the costs when the asset is in service. Asset Accounting will enter settlement rules in the project based on the information entered in the master data of the project record.

Project and WBS Status

There are four different statuses for a project or WBS element, each allows for different processes to occur. In the created status planning and settlement rule maintenance is allowed. In the released status additional planning, settlement rule maintenance, actual cost posting and settlement to AUC is allowed. When the status is changed to technically complete (TECO) settlement rule maintenance, actual cost posting and final settlement is allowed. The WBS status is moved to close when all costs are processed and costs are moved to the final asset.

Additional Information

For additional information regarding the use of Project and WBS elements, please refer to the Budget Guidelines.

PLANT IN SERVICE & RETIREMENT

4.1 Introduction

This chapter covers the policies related to custody, care, transfers, removal and or abandoning, and final disposal of capital assets within/from gas plant in service.

4.2 Capital Assets: Care, Custody and Control

Project/Asset Manager Responsible For

As part of their responsibility for the utilization, care and safekeeping of Terasen Gas capital assets under their control, managers shall ensure that:

- all transfers, removals from service are fully reported to them
- adequate internal controls are maintained
- all status change documents are forwarded to Asset Accounting

Asset Accounting Responsibility

Asset Accounting shall ensure that the accounting records correctly report additions, transfers, retirement, and changes of status, based on the information provided by the responsible managers.

General Ledger Capital Accounts

Accounts are setup on the Budget Guidelines Manual, Section 7, “Capital Budgets”. Manuals to capture the current year’s capital additions, retirements, related removal costs and salvage proceeds.

Subsidiary Plant Records

These accounts are called asset classes and are designed to classify the gas plant in service assets acquired or constructed and physically placed into service. These sub-accounts are primarily maintained by Asset Accounting and serve as subsidiary records to the GL100 and GL105 accounts. These asset classes can be found in the Budget Guidelines Manual, Section 7.3.3 Asset Class List.

PRU Catalogue

Asset Accounting maintains an inventory record of capital assets by Property Retirement Units (PRUs), as defined in the Property Retirement Unit Catalogue. The PRU Catalogue is an integral part of the Capitalization Policy. A PRU defines the lowest level of expenditure for capitalization and control.

Primary Sources

The primary sources of data for an accurate record of capital assets are, Fixed Asset Transfer (FAT) and Plant Retirement Requests (PRRs) documents. Each of these are discussed below.

4.3 Fixed Asset Transfers (FAT)

Change in Custody Only

Transfer of capital assets is confined to movements and changes in custody of one or more PRUs, which will continue to be used for the original or equivalent purpose.

Applies to

- General Plant or "portable type" PRUs when such units are physically transferred to another plant facility location in a different Capital District or Region
- Plant under construction (WIP), where existing PRUs are removed from one plant facility location and immediately re-installed, subject to cleaning or refurbishing, at a new project site under construction

Original Cost and Depreciation

The original cost, estimated if not known, of the PRU and, where applicable, the accumulated depreciation value is transferred. The accumulated depreciation applies where the transfer affects divisional boundaries.

Asset Transfer Document

The Asset Transfer form is prepared by the sending Cost Centre at the time the PRU is transferred, and must show the complete PRU description, make/type, serial number, year of acquisition, present and new locations, appropriate approvals and acknowledgement by the receiving cost centre.

4.4 Retirements

Service Value

The original cost or, where applicable, a reasonable estimate, is credited to the appropriate capital account with the offset entry to the accumulated depreciation account, for the PRU retired.

Items Less Than a PRU

- When plant, comprising less than a PRU, is removed and not replaced or improved upon in accordance with Section 2.3.2 "Improvements and Additions", no retirement entry will be made to the capital accounts at that time. Its value will be retired upon the retirement of the PRU with which it is associated.

- A retirement will be made where the PRU is rebuilt in excess of 50% of the replacement cost of a new plant unit of the same kind and class, see Section 2.3.3 "Rehabilitation/Major Renewals"

4.4.1 Specific Plant Retirement

Specific plant retirement occurs when:

Occurrences

- a complete PRU is physically removed or abandoned from plant in service
- an existing PRU is replaced
- improvements, substantial betterments, rehabilitations or major renewals are made to an existing PRUs concurrently with partial removal or abandonments to these PRUs. See Chapter 2, Sections 2.3.2 and 2.3.3

Documentation

- To maintain efficiency in processing documents on asset retirements/disposals, a separate form is used appropriate to the type of asset retirement. Refer to the Procedure Section of this manual.
- In the absence of specific retirement/disposal procedures, a Plant Retirement Request (PRR) is to be used.

4.4.2 Recurring Plant Retirement

Recurring plant retirement occurs when:

Occurrences

Mains (47500)	a main is removed or abandoned;
Services (47300)	a service line is deactivated to a stub service or, a complete service line is removed or abandoned;
Meter (47810)	a residential or commercial meter is removed from service

Quantity Reporting

No Plant Retirement (PRR) is required to retire Recurring Plant. In its place, annual plant unit reports for mains and services retired are generated by by running a Business Warehouse report in SAPFor meters retired monthly information is provided by the Measurement Group to Asset Accounting.

4.4.3 Retirement Accounting

By Asset Accounting

Asset Accounting Department makes all retirement accounting entries.

Unit Cost Tables

Retirement Unit Cost tables are computed annually for Recurring Plant, and used to establish retirement values based on quantity supplied by operations.

Original costs, estimate if not known, are used to retire Specific Plant PRUs.

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4.5 Removal Dismantling Costs

Associated With Retirements

Removal or dismantling costs are associated with asset retirements. It includes labour, material, contract services and other direct expenditures related to demolishing, dismantling, tearing down or otherwise removing PRUs from plant in service.

Refurbishing Costs

Costs incurred to refurbish “used” inventory or non-inventory materials recovered from gas plant in service is chargeable to the removal/dismantling project to which it relates; unless the refurbishment results in a rebuilt plant unit refer to Section 2.3.3 of this Manual.

Overhead

Overhead is NOT applied to removal/dismantling costs. Such costs are not considered significantly large in contrast to capital additions.

Negative Salvage Values

The provision for net negative salvage or removal costs are no longer included in deprecation but instead actual costs are estimated and included in cost of service and recovered from customers in each respective year. Any variances between the actual amount of net removal costs realized and the estimated amounts included in cost of service are recorded in a deferral account ‘Removal Cost Deferral Account’ by Asset Accounting.

4.6 Salvage/Proceeds Values

Credited to Work Order

Salvage or proceeds is the value of material recovered from capital retired and is credited to work orders.

Types of Salvage

Salvage value can be realized through:

- disposal by sale – salvage value is equal to the selling price
- recovery of large items to stock – reusable materials consisting of large individual items, usually a PRU, are salvaged at its original costs, estimated if not known
- recovery of small items to stock – reusable material consisting of relative small items, usually pipe fittings, is salvaged to stock at the prevailing inventory unit cost

Repair To Salvage Items

The cost incurred for repairing or refurbishing salvage items to its reusable condition, is part of the removal and dismantling process of asset retirement. When such repairs are done concurrent with the dismantling process, it can be charged to the appropriate dismantling/removal work order; otherwise, a new work order must be raised.

Insurance Claims

The value of insurance claim settlements received should be accounted for as follows:

- Property Retirement Unit (PRU) – as a salvage credit to the retirement of the PRU
- Non-Capital – the insurance proceeds will be credited to the account(s) chargeable with the expenditure necessary to restore the damaged plant

4.7 Gains and Losses on Disposal

Depreciable Assets

Gains or losses on asset disposal are transferred to a deferral account by asset accounting. Salvage proceeds realized whether through resale or recovery to inventory is credited to the accumulated depreciation reserve.

4.8 Inactive Plant

Classification

Assets retained but not longer considered actively engaged in gas utility operations are classified as Inactive Plant, and should either be:

- reclassified to gas plant held for future use
- disposed through resale
- removed/dismantled and scrapped

4.9 Fixed Assets Held For Resale

Initial Recording

Such assets are normally maintained in the capital account to which asset was initially recorded.

Intent To Dispose

If however, the intent to dispose of the asset by re-sale has been determined with no established date, and the asset is considered "inactive", then Asset Accounting may reclassify the asset to a separate capital sub-account, "Fixed Assets Held For Re-sale".

DEPRECIATION

5.1 Introduction

This Chapter covers the accounting policies concerning the computation of depreciation and the accounting treatment for special depreciable items of capital.

Matching Cost Concept

Capital expenditures are distributed as equitably as possible between present and future customers by matching these costs to the accounting period in which the associated benefits accrue. This is accomplished by the depreciation/amortization practices used by the Company.

5.2 Depreciation Versus Amortization

Allocation to Operating Expense

Both terms relate to allocating the cost of depreciable capital to operating expense except that:

- depreciation extends over the actual service life of the asset, where as
- amortization is limited to the contractual term of the asset

5.3 General Requirements

Basis of Depreciation

The basis is to allocate the cost of the depreciable asset, the salvage proceeds, over the estimated service life of an asset in a systematic and rational manner.

Commencement

Depreciation begins the month following when the asset is considered in-service.

Timing

Depreciation is provided on a straight-line basis, and computed in conformity with the "group system", i.e. a group of individual assets (PRUs) classified under the same capital account.

Method

Depreciation under the straight-line service-life method is computed by applying the annual percentage to the cost of depreciable capital as recorded in the capital account, divided by twelve for the monthly recording.

Rate

A separate rate for each asset class is used in computing depreciation.

Approval

The various rates are approved by regulatory authorities, e.g. BCUC.

The Service Life

The service life is the period of time between the installation or acquisition of the asset and its retirement for accounting purposes.

Depreciation Under Group System

The "group system" contemplates that some part of the investment in a group of assets will probably be recovered through salvage realizations, and that probably there will be variations in the service lives of assets constituting the group, even among assets of the same class. The depreciation provision determined for the group is a weighted average of the various individual provisions reflecting the individual expectancies of life and salvage for each PRU in the group.

Maintain Depreciation Records

It is not the intention of this group classification to require the Company to keep records of the accumulated depreciation of each PRU.

For the purposes of analysis, however, the Company shall maintain subsidiary records in which accumulated depreciation is sub-divided according to each group of Gas Plant Accounts.

5.4 Accounting For Special Depreciable Items

in rate base.

5.4.1 Contribution in Aid of Construction

Contribution credits in the G/L 21101 account are amortized over the average service lives of the capital assets to which they relate.

5.4.2 Leasehold Improvements

Leasehold improvements are amortized over the life of the lease (must be greater than 12 months), and retired from plant in service when occupancy is vacated.

5.4.3 Obsolete and Surplus Stock (Used)

The value of obsolete and/or surplus stock removed from inventory which can be identified as used items, shall be charged to accumulated depreciation as an adjustment to previous salvaged-credits realized.

5.5 Non-Depreciable Capital

Depreciation/amortization is not charged on:

- land and land rights
- work in progress
- inactive plant, unless by regulated agreement
- plant held for future use
- plant not in service

5.6 Disposal

When non-depreciable capital is disposed of through resale, the original cost of the asset is credited to the applicable capital account, and any substantial gain or loss is recorded as an extra ordinary item in the income statement. If this amount is not significant, it is reported as income or income deductions.

When depreciable capital is disposed of through resale the original cost of the asset is credited to the applicable capital account and charged to its corresponding accumulated depreciation account. The net salvage proceeds, if any is credited to the related accumulated depreciation account.

Attachment 99.2

Main Extensions

Replaces: CUS 07-08 dated 30 March 2006.

Overview

This specification outlines Terasen Gas requirements for initiating, processing, and obtaining approval for the construction of main extensions to the Terasen Gas Lower Mainland and Interior distribution systems in accordance with the Terasen Gas Inc., Terasen Gas (Vancouver Island) Inc., and Terasen Gas (Whistler) Inc. tariffs.

Audience

This document is intended for employees working in the Customer Contact Centre, Planning and Design, Marketing and administrators involved in the main extension process.

References

- ADM 04-01 *Authorization Levels*
- CUS 07-05 *Charges for Service Line Work*
- DES 04-02-01 *New Loads and Changes in Existing Loads*
- Form 1754 *Distribution System Capital Expenditure Approval/Summary*
- Economic Test Training Materials
- Terasen Gas Inc. Tariff
- Terasen Gas (Vancouver Island) Inc. Tariff
- Terasen Gas (Whistler) Inc. Tariff

Policy

Terasen Gas will make extensions to its gas distribution system according to development requirements, in a manner that is consistent with this standard and the Terasen Gas Inc. and Terasen Gas (Vancouver Island) Inc., and Terasen Gas (Whistler) Inc. tariffs. All main extensions will be the property of Terasen Gas.

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Definitions

Annual Consumption GJ/Unit

Annual consumption is the number of gigajoules consumed per premises, based on the building type, end use application, insulation, and normal degree-day conditions.

CAFE

Customer Attraction Front End (CAFE) is a custom software tool developed for Terasen Gas that provides a "front end" customer application tool to SAP. It is primarily used to process data resulting from customer related work such as gas service applications, main extensions, abandonments and alterations. CAFE is also configured to perform the economic test.

Contributing Customer

A contributing customer is a customer connecting to a main who must pay a contribution toward the cost of the main extension.

Direct Cost

The direct cost is the cost of an installation including labour (with concessions and benefits), vehicles, equipment, material, and contractors, excluding overhead and GST.

Discounted Cash Flow (DCF)

The DCF is a stream of costs or revenues over time, discounted to give the present value.

Double Main

A double main is an installation with mains on each side of a street. This eliminates road crossings for services or stubs installed with the main to the property line.

Economic Test

The Economic Test or formerly known as the Main Extension Test (MX Test) is a discounted cash flow analysis of the projected revenue and costs associated with the main extension and has been approved by the BCUC. The total revenues and costs for the main extension project are calculated over a 20-year period, based on the number of customers projected to connect to the main extension within five years of construction, along with their forecast annual consumption. The economic test determines whether or not a contribution is required from those customers connecting to the main extension within the first five years of construction.

GST

GST is the Goods and Services Tax.

Main Extension

A main extension is an extension of one of Terasen Gas' mains with distribution, intermediate or transmission pressures, and includes tapping of transmission pipelines, the installation of any required pressure regulating facilities and upgrading of existing Mains, or pressure regulating facilities on private property.

Main Extension Contribution

Also known as a contribution in aid of construction (CIAC), this represents the portion of the capital cost a customer must pay to offset the revenue deficiency of the main extension, as determined by the economic test.

Net Present Value (NPV)

The net present value (NPV) is determined through the economic test, and represents the present value of the expected cash flows over 20 years (both costs and revenues) of a proposed main extension. The net present value of a main extension is determined on a discounted cash flow basis.

A positive NPV indicates that the present value of the projected revenues exceeds the present value of the costs. A negative NPV indicates a revenue deficiency or shortfall.

Profitability Index (PI)

The profitability index (PI) is the revenue to cost ratio, which compares the present value of revenues expected from a main extension project to the present value of costs expected over a set period of time.

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Revenue Deficiency

A revenue deficiency or shortfall is the amount of additional revenue needed to achieve a zero NPV in the DCF analysis used in the economic test.

Service Line

The service line is the portion of Terasen Gas' gas distribution system extending from a main or a service header to the inlet of the meter set. In case of a vertical subdivision, or multi-family housing complex, the service line may include the piping from the outlet of the meter set to the customer's individual premises, but not within the customer's individual premises.

Service Header

A service header is a gas distribution pipeline located on private property connecting three or more service lines or meter sets to a main.

SAP

SAP is a business application software tool supports order fulfillment which includes customer related work such as gas service applications, main extensions, planning and work management tools. It also supports the financial, budgeting, controlling, materials management, inventory management, purchasing, measurement technologies, plant management, operate & maintain, and human resource functions.

Single Main

A single main is a main that runs on one side of a street, with services to customers on both sides of the street.

System Improvements (SIs)

System Improvements (SIs) are system reinforcements made to ensure that adequate system capacity is available to meet customer energy requirements at the minimum system pressure approved by System Planning. The treatment of SIs in the economic test evaluations is discussed in more detail below.

Vertical Subdivisions (VSD)

Vertical subdivisions (VSD) are a multi-storey building that has individually metered units and a common service header connecting banks of meters typically located on each floor.

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Terasen Gas

Initiating a Main Extension

When Terasen Gas determines that a main extension is needed to meet system development requirements, the planner will initiate a main extension scenario in CAFE to capture design details, pricing and options associated with the project.

Planning and Design

The Distribution Planning & Design Group is responsible for:

- Initiating jobs (or scenarios) in the appropriate systems.
- Ensuring that system job numbers are used on all correspondence and files.
- Determining the annual number of customers projected to connect to a main extension within five years of construction.
- Determining the annual consumption for each customer (see **Annual Consumption**) that is projected to connect to the main extension within five years of construction.
- Designing the pipe layout, size, length, and other facility requirements.
- Estimating direct costs for the main and associated facilities.
- Running the economic test and recording the results on **Form 1754** *Distribution System Capital Expenditure Approval/Summary* (see **Main Extension Test**).
- Communicating with the Commercial Sales and Marketing Manager, or the Commercial Account Representative regarding any main extension applications for main extensions for customers who exceed an estimated load of over 5,000 GJ per year. In these cases CAFÉ generates an automated alert to inform the above mentioned manager/representative, and they will arrange for any required contracts and also work with the Marketing Process Support Analyst to run the economic test.
- Informing Engineering and Transmission Operations about any applications requiring extensions to IP and TP pipelines.
- Providing a plan of all existing facilities connecting to IP or TP mains and facilities.
- Ensuring that enough gas service applications and contributions have been secured before advancing a project to the construction stage.

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- Providing a Load Information Memo (LIM) to System Planning for analysis of the main extension.
  - See **DES 04-02-01** *New Loads and Changes in Existing Loads*

- Communicating with the Right of Way group regarding the requirement of a right of way, or if there are infringements on Terasen Gas pipeline right of ways, and also ensuring that the required documentation is in place prior to construction.
- Ensuring that any required internal and external approvals are obtained prior to construction.
- Issuing the required documentation and construction drawings to the field.
- Ordering construction materials.
- Liaising with IRM Dispatch and Installation/Distribution Managers regarding resource ability, scheduling, and reviewing estimates.

Costs

Direct cost estimates for main extensions will be determined for the economic test based on the following guidelines:

- The direct cost estimate will include the size of the main and/or service header, and associated facilities required to serve the customers projected to connect to the distribution system within five years of construction.
  - The System Planning Manager may elect to install a larger main to allow for future growth. The customer will not be responsible for any additional costs associated with installing the larger main.

- A double main will be installed if it is the least cost alternative, or if it is required by local governments.
  - The least cost alternative will be determined by comparing the cost estimate of double mains plus the service lines, to the cost estimate of a single main plus service lines.
  - The cost of the double main will be included in the direct cost estimate.

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- Costs such as river crossings, bridges, surveying, land transaction costs, bedrock blasting, right of way clearing, and environmental impact investigations will be included in the direct cost estimate.
- Archaeological costs are the responsibility of the customer and will only be factored into the economic test if Terasen considers the costs a necessity to secure future growth.
- The planner will provide project specific service line direct cost estimates for all customers in the economic test.
- The planner will provide specific meter set direct cost estimates for large commercial and/or industrial customers in the economic test .
  - Typically, meter set costs for residential and small commercial customers are automatically selected by CAFÉ, but for larger load customers they are manually obtained and entered into CAFÉ to be used as an input for the economic test.

- SI costs are to be included as an input into the evaluation of a main extension for all customers.
- Incremental operating, maintenance, and overhead costs, and other appropriate fees are automatically calculated in the economic test based on each customer's rate class and annual projected load, and the direct cost estimate of the main, service lines, meter sets and other main extension components described above.

Annual Consumption

Residential and Small Commercial Customers

The Planner will forecast the annual consumption (GJ/customer) for residential and small commercial customers based on the type of premise(s) being connected, the building characteristics, and appliances expected to be connected.

Customers other than Residential and Small Commercial

The Planner will forecast the annual consumption (GJ/unit) for customers other than residential and small commercial on an individual basis, using similar criteria as for residential and small commercial customers, including building characteristics, expected appliances to be connected, equipment ratings, and also consumption data for comparable existing customers.

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Economic Test

As discussed above in the definitions, the economic test is a discounted cash flow analysis of the projected revenues and costs associated with a main extension.

The economic test will be applied to new applications for services requiring new gas mains, as well as for service header and vertical subdivision applications. In vertical subdivision applications, the direct cost estimate of the underground pipe, plus the building piping and associated equipment, will be used as the direct cost estimate of the main. Similarly, in service header applications, the direct cost estimate of the service header will be used as the direct cost estimate of the main.

- See **CUS 07-05** *Charges for Service Line Work*

The following data is required to run the economic test:

- System job number
- Direct cost of the main
- Direct cost of the service header
- Direct cost of each service line
- Direct cost of each meter
- Direct cost of each regulator
- Direct cost of common pressure regulating assemblies for vertical subdivisions
- Number of customers projected to be added annually within five years of construction
- Each customer's rate schedule
- Each customer's projected annual consumption (GJ/yr.).

If the economic test indicates a revenue deficiency, the customers will need to pay a contribution equal to the revenue deficiency in order for the project to proceed.

- See the Contributions section of this document.

The Sales and Marketing Manager will arrange for the economic test to be run for exceptionally large commercial and industrial customers.

Approvals

The Planning & Design Work Leader has the authority to give final approval to main extension applications if:

- The Planner has reviewed the application and signed the main extension authorization form.
- The total mains and facilities installation direct costs do not exceed \$50,000.

The Planning & Design Manager, has the authority to give final approval to main extension applications if:

- The Planner and Planning & Design Work Leader has reviewed the application and signed the main extension authorization form.
- The total mains and facilities installation direct costs do not exceed \$100,000
- The appropriate approvals from other departments are received.

The Director, Operations Centre has the authority to give final approval to main extension applications if:

- The Planning & Design Manager has reviewed the application.
- The total mains and facilities installation direct costs do not exceed \$250,000.
- The appropriate approvals from the Customer Management & Sales Department are received to confirm the forecast number of attachments and projected annual consumption.
- The appropriate approvals from other departments are received.

The VP, Distribution has the authority to give final approval to main extension applications if:

- The Manager, Operations Centre has reviewed the application.

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- The total mains and facilities installation direct costs do not exceed $500,000, in accordance with the capital approval levels identified in **ADM 04-01***Authorization Levels.*
- The appropriate approvals from the VP, Marketing & Business Development is received to confirm the forecast customer attachments and projected annual consumption.
- The appropriate approvals from other departments are received

Main extension applications not eligible for approval by the VP, Distribution will require the approval of the President, Gas Segment, up to $2,000,000 in accordance with the capital approval levels identified in **ADM 04-01** *Authorization Levels.*

Main extensions requiring connection to the Terasen Gas transmission system (excluding service lines from IP pipelines) require the approval of the Manager, Transmission Operations.

Main extensions that may infringe on an existing Terasen Gas transmission pipeline right of way require the approval of the Manager, Property Services.

Main extensions that require system improvements or oversizing to accommodate future load growth, or involving pipe sizes of 114 mm or larger, require the approval of the System Capacity Planning Manager and the Distribution Assets and Improvements Manager.

Main extensions that require alteration to, or the construction of, a new pressure reducing facility, require the approval of the Distribution Assets and Improvements Manager.

Those providing approvals of main extensions must sign **Form 1754***Distribution System Capital Expenditure Summary/Approval.*

Variances

Installation/Distribution Managers are responsible for ensuring that the main extension is installed as designed and approved. If any changes are necessary, the Installation/Distribution Manager, in conjunction with the Planner, must alter the design and obtain the necessary approval before construction.

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Any completed main extensions with significant variances will be identified and reviewed by the Planning & Design Manager. The Planner and Installation/Distribution Manager will work together to explain the variance and any explanations will be kept in the project work order file.

Contributions

When the results of the economic test indicate a profitability index of less than 0.8 for TGI & TGVI or less than 1.0 for TGW, Terasen Gas will collect a contribution from the customers initially connecting to the main extension.

Contributions will not be adjusted based on updated or actual revenues and/or costs unless approved by the appropriate Marketing manager (Manager, Residential & Commercial Energy Solutions or Manager, Commercial and Industrial).

Quotations to customers for main extensions must be given in writing. These quotations are normally valid for 90 days. The Planning & Design Manager must approve any extensions to the 90 day period.

Construction may only begin after:

- The required contributions are collected from customers initially connecting to the main.
  or
- Agreement is obtained to have the contribution funded through regional taxation.
  and
- All required permits and approvals are obtained.

The Planning & Design Manager may waive contributions of less than $100 per customer connecting to the main extension.

Contribution

The total required contribution will be paid by the Customers connecting at the time the main extension is built. Terasen Gas will collect contributions from all customers connecting during the first five years after the main extension is built. As additional contributions are

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received from customers connecting to the main extension, partial refunds will be made to those customers who had previously made contributions. At the end of the fifth year, all customers will have paid an equal contribution, after reconciliation and refunds.

For larger main extension projects, Terasen Gas may use a main extension contribution agreement for initial contributions. Customers will be billed the contribution based on the terms of the agreement.

Situations that cannot be resolved using the above guidelines will be referred to the Customer and Energy Forecasting Manager.

Refunds

A review will be performed annually, or more frequently at the Company's discretion, to determine if a refund is payable to all customers who have contributed to the extension.

If the review of contributions indicates that refunds are due:

- Individual refunds greater than $100 will be paid at the time of the review.
- Individual refunds less than $100 will be held until a subsequent review increases the refund payable to more than $100, or until the end of the five-year contributory period.
- No interest will be paid on contributions that are subsequently refunded.
- The total amount of refunds issued will not be greater than the original amount of the contribution.
- If, after making all reasonable efforts, Terasen Gas is unable to locate a customer who is eligible for a refund, the customer will be deemed to have forfeited the contribution refund and the refund will be credited to the other customers who contributed towards the main extension.

Contributory main extensions and service headers will be identified in the GIS system and also on the plate maps. The GIS system and plate map will have all main extensions labeled with a unique number, and contributory main extensions will have a suffix of "$YR" ("YR" is the year the main was installed).

Terasen Gas

Main Extension Refund Database

The contribution amount for each contributory main extension will be tracked in the Main Extension Refund Database. The Marketing Process Support Analyst (administrator) will administer the database. The Planners will have read-only access to the database reports, through a folder on the Terasen Gas "S drive". The Planner will complete the mains contribution database input form, and forward it to the administrator for each customer addition to an existing or new contributory main extension.

The administrator is to coordinate the issuing of refunds and also maintain the refund database.

Extensions to Contributory Extensions

When a main extension is being attached to an existing contributory main extension that was constructed less than five years ago, those customers connecting to the new extension may be required to pay a contribution towards the older contributory main extension as well as towards the new main extension. The new main extension will be evaluated using the economic test to determine whether a contribution is required for that extension, and then a prorated portion of the total contribution required for the existing contributory main will also be assigned to those customers connecting to the new main extension.

If an application for an extension to a contributory main extension is received, the Planner will notify the Marketing Process Support Analyst who will then determine the amount of the contribution for the extension of the contributory extension.

GST

The GST must be added to any contributions collected from the customer. It must be noted separately in any correspondence (including receipts), making reference to the Terasen Gas GST registration number for the appropriate company.

Records

Form 1754 *Distribution System Capital Expenditure Approval/Summary* must be completed and signed as indicated in **Planning and Design** and **Approvals**. The completed forms are to be forwarded to and retained in the Planning and Design Department

Caution: Printed documents may not be current. Verify online.

Attachment 100.1

REFER TO LIVE SPREADSHEET

Provided in electronic format only

(accessible by opening the Attachments Tab in Adobe)

Attachment 100.4

Main Extensions

Terasen Gas

Replaces: DES 04-03-08 [OI PLN 100-3] dated 14 September 1998.

Overview

This specification outlines Terasen Gas requirements for initiating, processing, and obtaining approval for the construction of main extensions to the Terasen Gas lower mainland and interior distribution systems in accordance with the **Terasen Gas Tariff** *General Terms and Conditions*, Section 12.

Audience

Install Coordination Centre staff, marketing staff, and administrators involved in the main extension process.

References

- ADM 04-01 *Authorization Levels*
- CUS 07-05 *Charges for Service Line Work*
- DES 04-02-01 *New Loads and Changes in Existing Loads*
- DES 04-02-10 *Charges for Service Line Work*
- GEN 01-03 *Technical Definitions (Terminology)*
- Form 1754 *Main Extension Approval Summary*
- MX Training Materials
- **Terasen Gas Tariff** *General Terms and Conditions*

Policy

Terasen Gas will make extensions to its gas distribution system according to development requirements, in a manner that is consistent with this standard and the **Terasen Gas Tariff**. All main extensions will be the property of Terasen Gas.

Definitions

Annual Consumption GJ/Unit

Annual consumption is the number of gigajoules consumed per premises, based on the building type, end use application, insulation, and normal degree-day conditions.

Terasen Gas

Contributing Customer

A contributing customer is a customer connecting to a main who must pay a contribution toward the cost of the main extension.

Contribution

A contribution is the portion of the capital cost a customer must pay to offset the revenue deficiency of the main extension.

Direct Cost

The direct cost is the cost of an installation including labour (with concessions and benefits), vehicles, equipment, material, and contractors, excluding overhead and GST.

Discounted Cash Flow (DCF)

The DCF is a stream of costs or revenues over time, discounted to give the present value.

Double Main

A double main is an installation with mains on each side of a street. This eliminates road crossings for services.

Extension

An extension is an extension of a Terasen Gas distribution or transmission main, including additional pressure regulating facilities and headers.

GST

GST is the Goods and Services Tax.

Header

A header is common gas distribution piping on private property serving three or more customers.

Main Extension (MX) Test

The MX Test is used to determine the forecast Net Present Value of a main extension. It is explained in detail in this standard.

Caution: Printed documents may not be current. Verify online.

MX Test Program

The MX Test program is a computer program used to calculate the MX Test results.

Net Present Value (NPV)

The NPV is the result of the MX Test comparing projected revenues and costs of a proposed main extension on a discounted cash flow basis.

A positive NPV indicates that the present value of the projected revenues exceeds the present value of the costs. A negative NPV indicates a revenue deficiency or shortfall.

Revenue Deficiency

A revenue deficiency or shortfall is the amount of additional revenue needed to achieve a zero NPV in the DCF analysis used in the MX Test.

Service Line

A service line is the portion of the gas distribution system extending from the main to the meter set inlet.

SAP

Terasen Gas business application software that includes main extension planning and work management tools.

Single Main

A single main is a main that runs on one side of a street, with services to customers on both sides of the street.

System Improvements (SIs)

SIs are system reinforcements made to ensure that adequate system capacity is available to meet customer requirements at a minimum system pressure approved by System Planning. The treatment of SIs in MX evaluations is discussed in more detail below.

Vertical Subdivisions

A vertical subdivision is a multi-storey building that has individually metered units and a common service line connecting banks of meters typically located on each floor.

Terasen Gas

Initiating a Main Extension

When Terasen Gas determines that a main extension is needed to meet system development requirements, the Install Coordinator will initiate the main extension by completing the appropriate screens on SAP.

Planning and Design

The Install Coordination Centre is responsible for:

- Initiating jobs on SAP.
- Ensuring that a SAP job number is used on all correspondence and files.
- Determining the annual number of customers projected to connect to a main extension within five years of construction.
- Determining the annual consumption for each customer (see **Annual Consumption**).
- Designing the pipe layout, size, length, and other facility requirements.
- Estimating direct costs for the main and associated facilities.
- Running the MX Test and recording the results on **Form 1754** *Main Extension Approval Summary* (see **Main Extension Test**).
- Informing the Commercial Sales and Marketing Manager or the Commercial Account Representative about any main extension applications to other than Rate 1, 2, or 3 customers (estimated load over 5000 GJ/yr). The Commercial Sales and Marketing Manager or Commercial Account Representative will arrange for any required contracts and for the Sales and Administration Business Analyst to run the MX Test program.
- Informing Engineering and Transmission Operations about any applications requiring extensions to IP and TP pipelines.
- Providing a plan of all existing facilities connecting to IP or TP mains and facilities.
- Ensuring that enough gas service applications and contributions have been secured before advancing a project to the construction stage.
- Providing a Load Information Memo (LIM) to System Planning for analysis of the main extension.
    - See **DES 04-02-01** *New Loads and Changes in Existing Loads*

Caution: Printed documents may not be current. Verify online.

- Informing the Right of Way group about any infringements on Terasen Gas pipeline rights of way, and ensuring that the required documentation is in place prior to construction.
- Informing the Lands group if a right of way is required.
- Issuing the required documentation and construction drawings to the field.
- Ensuring that any required internal and external approvals are obtained.
- Ordering construction materials.

Costs

Direct cost estimates for main extensions will be determined for the MX Test based on the following guidelines.

- The direct cost estimate will include the size of the main and/or service header, and associated facilities required to serve the customers projected to connect to the distribution system within five years of construction.
  - The System Planning Manager may elect to install a larger main to allow for future growth. The customer will not be responsible for any additional costs associated with installing the larger main.
- A double main will be installed if it is the least cost alternative, or if it is required by local governments.
  - The least cost alternative will be determined by comparing the cost estimate of double mains plus the service lines, to the cost estimate of a single main plus service lines.
  - The cost of the double main will be included in the SAP direct cost estimate.
- Costs such as river crossings, bridges, surveying, land transaction costs, bedrock blasting, right of way clearing, and environmental impact investigations will be included in the direct cost estimate.
- The install coordinator will provide project specific service line direct cost estimates for all customers in the MX Test program.
- The install coordinator will provide specific meter set direct cost estimates for Rate 3 customers in the MX Test program.

- Meter set costs for Rate 1 and 2 customers will be automatically selected by the MX Test program, based on the annual projected load.

- SI costs will be included in the evaluation of an main extension based on the following.
  - Average SI costs are automatically calculated based on each customer's annual projected load in the MX Test program for Rate 1, 2, 3, and 23 customers.
  - Average SI costs, adjusted to the customer's projected load factor, will be included in the MX Test program for firm customers (Rate 5, 25, and 22 customers).
  - Project specific SI costs will be included in the direct cost estimate for interruptible and seasonal customers (customers in Rates 4, 7, 27, and 22).
- Incremental operating, maintenance, and overhead costs are automatically calculated in the MX Test program based on each customer's rate class and annual projected load, and the direct cost estimate of the main, service lines, meter sets and other MX components described above.

Annual Consumption

Rates 1 and 2

The install coordinator will forecast the annual consumption (GJ/unit) for Rate 1 and 2 customers by running the MX Test program. The consumption section of the MX Test program estimates a customer's annual gas consumption based on:

- Type of premise
- Building characteristics
- Normalized area weather conditions
- Appliances connected (e.g., domestic water heater, furnace, dryer, range)

Rates Other Than 1 and 2

The Install Coordinator will forecast the annual consumption (GJ/unit) for customers other than Rate 1 and 2 on an individual basis, using criteria such as heat loss calculations, equipment ratings, and consumption data for comparable existing customers.

Main Extension Test (MX Test)

The MX Test is a discounted cash flow analysis of the projected revenue and costs associated with the main extension. The total revenues and costs for the main extension project are calculated over a 20-year period, based on the number of customers projected to connect to the main extension within five years of construction, and their forecast annual consumption. The main extension will be deemed to be economic, and may be constructed without contributions, if the results of the MX Test indicate a zero or greater net present value, provided the required approvals are obtained.

The MX Test will be applied to new applications for service requiring new gas mains, as well as for service header and vertical subdivision applications. In vertical subdivision applications, the SAP direct cost estimate of the underground pipe, plus the building piping and associated equipment, will be used as the SAP direct cost estimate of the main. Similarly, in service header applications, the SAP direct cost estimate of the service header will be used as the SAP direct costs estimate of the main.

- See **DES 04-02-10** *Charges for Service Line Work*

The following data is required to run the MX Test for Rate 1, 2, 3, or 23 customers:

- SAP job number
- Direct cost of the main
- Direct cost of the service header
- Direct cost of the service lines
- Direct cost of the meter manifolds with three or more meters for Rate 1 customers
- Direct cost of meter manifolds with two or more meters for other than Rate 1 customers
- Direct cost of common pressure regulating assemblies for vertical subdivisions
- Whether the meter manifolds have common regulators or individual regulators

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- Number of customers projected to be added annually within five years of construction
- Each customer's rate schedule
- Each customer's projected annual consumption (GJ/yr.)
- Meter set direct costs for Rate 3 or 23 customers.

If the MX Test indicates a revenue deficiency, the customers will need to pay a contribution equal to the revenue deficiency in order for the project to proceed.

- See the Contributions section of this document.

The Sales and Marketing Manager will arrange for the MX Test to be run for customers on rates other than Rate 1, 2, 3, or 23.

Approvals

The Install Centre Manager has the authority to give final approval to main extension applications if:

- The install coordinator (IC1) has reviewed the application and signed the main extension authorization form.
- The total mains and facilities installation direct costs do not exceed $100,000.
- The appropriate approvals from other departments are received.
- Jobs with total mains and facilities installation direct costs exceeding $50,000 require sign off by the Install Centre Manager.
- Jobs with total mains and facilities installation direct costs less than $50,000 will be reviewed using exception reporting, and individual main extension authorization forms do not require sign off by the Install Centre Manager

The Manager, Operations Centre has the authority to give final approval to main extension applications if:

- The Install Centre Manager has reviewed the application.
- The total mains and facilities installation direct costs do not exceed $250,000

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- The appropriate approvals from other departments are received.

The VP, Distribution has the authority to give final approval to main extension applications if:

- The Manager, Operations Centre has reviewed the application.
- The total mains and facilities installation direct costs do not exceed $500,000, in accordance with the capital approval levels identified in **ADM 04-01** *Authorization Levels.*
- The appropriate approvals from other departments are received.

Main extension applications not eligible for approval by the VP, Distribution will require the approval of the President, Gas Segment, up to $2,000,000 in accordance with the capital approval levels identified in **ADM 04-01** *Authorization Levels.*

Main extensions requiring connection to the Terasen Gas transmission system (excluding service lines from IP pipelines) require the approval of the Manager, Transmission Operations.

Main extensions that may infringe on an existing Terasen Gas transmission pipeline right of way require the approval of the Manager, Property Services.

Main extensions that require system improvements or oversizing to accommodate future load growth, or involving pipe sizes of 88 mm or larger, require the approval of the System Capacity Planning Manager and the Distribution Assets and Improvements Manager.

Main extensions that require alteration to, or the construction of, a new pressure reducing facility, require the approval of the Distribution Assets and Improvements Manager.

Those providing approvals of main extensions must sign **Form 1754** *Main Extension Approval Summary.*

Variances

Asset Managers are responsible for ensuring that the main extension is installed as designed and approved. If any changes are necessary, the

Asset Manager, in conjunction with the Install Coordinator, must alter the design and obtain the necessary approval before construction.

Upon completing the main extension, a job detail summary report will be produced to identify the actual and estimated costs. Any significant variances will be explained by the Asset Manager. The report and any explanations will be kept in the project work order file.

Contributions

When the results of the MX Test indicate an NPV less than zero, Terasen Gas will collect a contribution in the amount required to eliminate the negative NPV from the customers initially connecting to the main extension.

Contributions will not be adjusted based on updated or actual revenues and/or costs unless approved by the appropriate Marketing manager (Manager, New Construction and Residential Growth or Manager, Commercial and Industrial).

Quotations to customers for main extensions must be given in writing. These quotations are normally valid for 60 days. The Install Centre Manager must approve any extensions to the 60 day period.

Construction may only begin after:

- The required contributions are collected from customers initially connecting to the main.
  or
- Agreement is obtained to have the contribution funded through regional taxation.
  or
- A sufficient number of customers agree to pay the contribution by signing the Terasen Gas Main Extension Contribution Agreement (to be implemented).
  and
- All required permits and approvals are obtained.

The Install Centre Manager may waive contributions of less than $100 per customer connecting to the main extension.

Contribution Amounts

The amount that each contributing customer will pay will be determined in a fair and reasonable manner. If all contributing customers are on Rates 1 and 2, then each customer will pay an equal contribution amount. If one or more customers are other than Rate 1 or 2, then the following guidelines will be used to determine the amount of the contribution for each customer:

1. The MX Test will be run in three ways:
   - With Rate 1 and 2 customers only (Result A)
   - With customers other than Rate 1 and 2 customers (Result B)
   - With all customers (Result C)
2. If either Result A or Result B is non-contributory, then that group will not pay a contribution.
3. No group will pay a contribution larger than its stand-alone contribution (i.e. Result A or Result B).
4. If Result C is less than Result A + Result B, then the total contribution (Result C) will be apportioned to the other two groups in the same proportion as Results A and B, unless guideline 2 or 3 is in effect.
5. Within the Rate 1 and 2 groups, all customers pay the same contribution.
   - If there is more than one customer in the non-Rate 1 or 2 groups, the contribution will be apportioned within that group using techniques similar to those described above.

Situations that cannot be resolved using the above guidelines will be referred to the Marketing Planning Manager.

- See **Terasen Gas Tariff** *General Terms and Conditions* Section 12.6 "Contributions in Aid of Construction"

Refunds

All Rate 1 and 2 customers connecting to a contributory main extension during its first five years of existence will pay the same net contribution at the end of the five year period. This equity will be achieved through a series of contributions and refunds.

The initial customer's contributions and refunds will be calculated as described in the contributions section of this document. Subsequent or infill customers will be identified as having applied to connect to a contributory main extension.

Contributory main extensions and service headers will be marked on plate maps. The plate map will have all main extensions labelled with a unique number, and contributory main extensions will have a suffix of "$YR" ("YR" is the year of the MX Test used).

- See **Terasen Gas Tariff** *General Terms and Conditions* Section 12.8 "Refund of Contributions"

MX Refund Database

The contribution amount for each contributory main extension will be tracked in the MX Refund Database. The Marketing Pricing Analyst (administrator) will administer the database. The install coordinators will have read-only access to the database, through the public folders on the Terasen Gas electronic mail system. The install coordinator will complete the MX contribution database input form, and forward it to the administrator for each customer addition to an existing or new contributory main extension.

The administrator will notify the Financial Accounting Clerk to issue refunds and will update the database.

Refund Process Example

The refund process is illustrated by the following example:

Caution: Printed documents may not be current. Verify online.

Table 1: Refund Process

Total contribution required 12 initial customers each pay	$12,000 $1,000	(12,000 / 12 customers)
Four additional first year customers pay First year reconciliation: each of the 12 initial customers refunded	750 250	($12,000/ 16 customers) [(4 X $750)/ 12 customers]
Four second year customers each pay Second year reconciliation: each of the 16 customers refunded	600 150	($12,000/ 20 customers) [(4 X $600)/ 16 customers]
Four third year customers each pay Third year reconciliation: each of the 20 customers refunded	500 100	($12,000/ 24 customers) [(4 X $500)/ 20 customers]

The process continues for five years. Final refunds are issued at the end of five years.

For main extensions with other than Rate 1 or 2 customers, refunds will be prorated amongst the rate classes, on the basis of their original contributions.

Refund Guidelines

The following guidelines will be used when refunds are due:

- Individual refunds greater than $100 will be paid at the time of the review.
- Individual refunds less than $100 will be held until a subsequent review, when they become greater than $100, or until the end of the five-year contributory period.
- No interest will be paid on contributions that are subsequently refunded.
- If, after reasonable efforts, and five years have passed since the main was constructed, Terasen Gas cannot locate a customer eligible for a refund, the customer will be deemed to have forfeited the refund, and it will be credited to the other customers who contributed toward the main extension.

See **Terasen Gas Tariff** *General Terms and Conditions* Section 12.7 "Contributions Paid by Connecting Customers", and Section 12.8 "Refunds of Contributions"

Extensions to Contributory Extensions

When a new main extension is connected to an existing contributory extension, during the first five years of its existence, the customers on the new main may pay a contribution toward the existing extension. The amount of the contribution will typically be a portion of the total contribution for the existing main extension, assigned to the new main extension based on expected use, point of connection and other factors. In addition, customers on the new extension will pay any contribution required for the new extension.

The install coordinator will notify the Customer Care Manager of any applications for extensions to contributory extensions. The Customer Care Manager will determine amount of the contribution for applications for extensions to contributory extensions.

GST

The GST must be added to any contributions collected from the customer. It must be noted separately in any correspondence (including receipts), making reference to the Terasen Gas GST Registration Number (R100431592). When charged or collected, the GST should be coded to Account 251-018.

Records

Form 1754 *Main Extension Approval Summary* must be completed and signed as indicated in **Planning and Design** and **Approvals**. The completed forms are to be forwarded to and retained in the Install Centre.

Attachment 101.2

Diane Roy
Director, Regulatory Affairs - Gas
FortisBC Energy Inc.

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June 1, 2011

British Columbia Utilities Commission
6th Floor, 900 Howe Street
Vancouver, BC
V6Z 2N3

Attention: Ms. Alanna Gillis, Acting Commission Secretary

Dear Ms. Gillis:

Re: FortisBC Energy Inc. ("FEI") and FortisBC Energy (Vancouver Island) Inc.[1] ("FEVI") 2010 Year End Reports for:

- **FEI-FEVI Main Extension ("MX") Report – British Columbia Utilities Commission (the "Commission") Order No. G-152-07 Compliance Filing; and**
- **FEI Vertical Subdivision Report – Commission Order No. G-6-08 Compliance Filing**

On December 6, 2007, the Commission issued Order No. G-152-07 and Reasons for Decision approving changes to the FEI-FEVI System Extension and Customer Connection Policies. Subsequently, FEI was directed to make revisions to the MX test methodology and to provide information relating to Vertical Subdivisions under Commission Order No. G-6-08 issued on January 10, 2008.

The Companies applied the MX Test (also referred to as the "economic test") as approved by the Commission to 2007, 2008 and 2009 main extensions, and filed the respective Main Extension reports in compliance with the requirements of orders G-152-07 and G-6-08 on April 7, 2008, April 3, 2009 and April 10, 2010 respectively.

The Companies and Commission Staff have engaged in dialogue with respect to the 2010 MX Report via written correspondence, phone calls and a meeting on February 15, 2011 to review the compliance reporting requirements. In addition, the Companies provided a draft report on March 31, 2011 to Commission Staff for discussion and met with Commission Staff on April 12, 2011 to present the findings contained within the draft report. Commission Staff provided comments on the draft report on April 20, 2011.

As an outcome of the ongoing dialogue and pursuant to Commission Order Nos. G-152-07 and G-6-08, the Companies respectfully submit the attached 2010 FEI and FEVI Year End Main Extension and FEI Vertical Subdivision reports.

---

[1] Formerly Terasen Gas Inc. ("TGI") and Terasen Gas (Vancouver Island) Inc. ("TGVI"), respectively.

We trust that the Commission will find the reports in order. If there are any questions, please contact Paul Craig at 604-592-7459.

Yours very truly,

FORTISBC ENERGY INC.
FORTISBC ENERGY (VANCOUVER ISLAND) INC.

Original signed by Paul Craig:

For: Diane Roy

Attachments

cc (email only): Registered Parties to the TGI and TGVI 2010-2011 Negotiated Settlement Agreements

FortisBC Energy Inc. and
FortisBC Energy (Vancouver Island) Inc.

Main Extension Report

and

FortisBC Energy Inc.

Vertical Subdivision Report

for 2010 Year End

Compliance filing in Accordance with

Commission Orders No. G-152-07 and G-6-08

June 1, 2011

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Index of Tables and Figures

1 EXECUTIVE SUMMARY

The Main Extension ("MX") Report from FortisBC Energy Inc. ("FEI") and FortisBC Energy (Vancouver Island) Inc. ("FEVI") (collectively the "Companies") and the FEI Vertical Subdivision ("VSD") Report for 2010 Year End (collectively referred to as the "Report") are respectfully filed in accordance with Commission Orders G-152-07 and G-6-08.

The four key findings for consideration from the Report are summarized below.

1. The Companies are in compliance with the relevant Commission reporting directives.

Each of the compliance requirements under Commission Orders G-152-07 and G-6-08 have been addressed within the Report. The Introduction section provides the specific page reference where each compliance requirement has been addressed.

Further, the Companies have made improvements to the Report that the Companies believe will provide the Commission with greater insight into the results over the five year period of main extension projects.

2. The variance in forecast versus actual 2010 main extension costs is reasonable and the cost estimating processes followed by the Companies continue to be appropriate.

The actual main extension costs compared to forecast main extension costs were $0.1 million and $0.2 million lower for FEI and FEVI respectively. In comparison, the total, actual capital costs were $2.9 million and $0.9 million for FEI and FEVI, representing only 0.1% and 0.2% of their respective approved 2010 rate base. Based on the 2010 results, geo code pricing continues to be an appropriate method of forecasting main extension costs for the majority of the population. As discussed in last year's report, the Companies have identified that for a small number of main extensions, the geo code pricing methodology is not the most appropriate estimating method, and thus have made improvements by implementing a manual cost estimating process in order to ensure that the forecast costs for these main extensions are as accurate as possible. FEVI introduced the manual cost estimating process on a pilot project basis in early 2010, and this was subsequently introduced to FEI later in 2010.

3. A rebound in the 2010 BC housing market is reflected in positive consumption results for 2008-2010 main extension projects.

The BC housing market and the Companies' consumption results are closely related. The Report shows that both the BC housing market and the Companies' customer attachments have been highly cyclical in the recent past. Results for main extensions from 2008 to 2010 indicate that with the economy returning to growth following a bearish period, BC building developments have picked up and, in turn, the Companies' consumption and attachment results have improved. Housing starts are forecast to grow slightly in 2011 and the Companies' customer attachments are expected to follow this trend as well.

However, several factors could adversely affect growth prospects, including higher home prices from the HST, higher interest rates and new mortgage rules. Inevitably there will always be uncertainty and variability inherent in forecasting housing attachments, despite the Companies' best efforts to apply their industry knowledge, experience and conservative approach to forecasting.

4. In 2010, the number of main extensions, the forecast attachments and system throughput has dropped significantly compared to previous years.

Although 2010 represents a return to modest growth in the BC housing market and the forecast versus actual attachments have improved relative to 2009, the number of main extensions and forecast attachments in 2010 are approximately 50% lower than 2008 levels. This significant decline can be partially attributable to the wide capital cost differential between natural gas and electricity in heating and hot water heating applications, the cornerstones of our gas business. The drop in the number of main extensions and forecast attachments is happening concurrently with a 4.27%[1] drop in overall normalized system throughput between 2008 and 2010. The Companies will continue to monitor and report to the Commission on these concerning trends in subsequent MX reports.

In summary, on a portfolio basis for both FEI and FEVI, the main extensions installed are economical and do not harm existing customers, as demonstrated by the fact that the forecast profitability index ("PI") values are 1.8 and 2.5 respectively. In fact, the addition of economical main extensions benefits existing customers, especially in an environment where the Companies are experiencing a decline in the number of main extensions, attachments and system throughput. As such, the PI thresholds as determined in Order G-152-07 do not need to be adjusted on a going-forward basis as results demonstrate that existing customers are not adversely affected by the addition of a new customer or customers.

[1] System throughput includes FEI and FEVI residential, commercial, industrial and transportation customers.

2 INTRODUCTION

The following section provides the regulatory history of the MX Test, a summary outlining that the Companies are in compliance with the relevant Commission reporting requirements, and an overview of the Report.

The Companies have provided all relevant information in the Report in accordance with Commission Order Nos. G-152-07 and G-6-08, and the Executive Summary section above summarized the most salient issues from the Report. The Companies believe that the format of the Report and information provided in this Report allow the Commission to conduct an efficient regulatory review of the Companies' main extension activities and results over the five-year time frame.

2.1 MX Test Regulatory History

On July 31, 2007, the Companies applied to the Commission for changes to the System Extension and Customer Connection Policies ("TGI-TGVI System Extension and Customer Connection Policies Review")[2]. In December, 2007, the Commission issued Order No. G-152-07 and Reasons for Decision approving changes to the TGI-TGVI System Extension and Customer Connection Policies Review. The 2007 order (G-152-07) established the parameters for the Main Extension ("MX") test and the Companies were directed to file with the Commission a MX report (page 37 of G-152-07 and Reasons for Decision):

> *"within 90 days of calendar year end, a Main Extension Report including the following:*
>
> - *a review of a random sampling of MX test results representing a confidence interval of +/- 12 percent at a 95 percent confidence level and the five highest cost main extensions to determine if the aggregate PI thresholds need to be adjusted on a go forward basis in order to achieve the aggregate PI of 1.1. The review is to include a comparison of forecast and actual costs; consumption; and PI for the first five years of main extensions in the sample;*
> - *a concise explanation of the random sampling methodology used; and*
> - *a comparison of the forecast and actual cost for all service line and main extension installations."*

Subsequently, FEI was directed to make revisions to the MX test methodology and were further directed to provide information relating to Vertical Subdivisions under Commission order G-6-08[3] issued on January 10, 2008:

[2] Terasen Gas Inc. (TGI) and Terasen Gas (Vancouver Island) Inc. (TGVI) are the former names for FortisBC Energy Inc. (FEI) and FortisBC Energy (Vancouver Island) Inc. (FEVI) respectively.

[3] Order Number G-6-08 was issued in response to an application by TGI to amend the general terms and conditions of its Tariff to allow an alternative method of providing gas service to Vertical Subdivision developments.

> *"Terasen is directed include, in the Main Extension Report that Terasen was directed to file in the Commission's Main Extension Decision, the results of TGI's main extension tests to Vertical Subdivisions."*

The Companies applied the MX Test (also referred to as the "economic test") as approved by the Commission to 2007, 2008 and 2009 main extensions, and filed the respective Main Extension reports in compliance with the requirements of orders G-152-07 and G-6-08 on April 7, 2008, April 3, 2009 and April 10, 2010 respectively.

As a result of discussions with Commission Staff subsequent to the filing of the 2009 Report and a meeting with Commission Staff held on July 13, 2010, the Companies submitted a revised 2009 Report on August 18, 2010 with further information. FEVI also submitted a detailed report for the Shawnigan Lake Main Extension, providing additional information and explanations for the performance of the Shawnigan Lake Main Extension based on available information.

The Companies and Commission Staff have continued their dialogue with respect to the MX Report via written correspondence, phone calls and a meeting on February 15, 2011 to review the compliance reporting requirements. The Companies filed a draft report on March 31, 2011 prior to filing this final report. The Companies also met with Commission Staff on April 12, 2011 and presented the findings contained within the draft report. Commission Staff provided comments on the draft report on April 20, 2011.

The table below provides a summary of the various Commission directives and the specific page reference in the Report where each directive is addressed.

Table 1: Reporting Requirements Met by the Companies

Order Number	Compliance Reporting Requirement	Report Page Reference #
G-152-07	Provide schedules comparing the existing and updated geo-codes and MX Test input parameters.	p.8-15
G-152-07	Update FEVI MX Test to refelect FEVI use per appliance	p.9
G-152-07	Reflect in the Companies' MX tests their experience of consumption ramp-up in the early months of service	p.12
G-152-07	Comparison of forecast and actual costs, consumption and PI for the first five years of main extensions in the sample	p.21-28
G-152-07	A concise explanation of the random sampling used	p.15-16
G-6-08	Confirm that it reflects, in the MX test inputs, the fact that larger developments may require several years before all units are occupied and normal consumption patterns are established.	p.12
G-6-08	The results of FEI's main extension tests to Vertical Subdivisions	p.24

The Companies believe that they are in full compliance with the directives set forth in Order Nos. G-152-07 and G-6-08.

As cited above, in Order No. G-152-07, the Commission specifically directed three categories of information to be included in the Companies' annual compliance report:

1. a review of a random sampling of MX test results representing a confidence interval of +/-12 percent at a 95 percent confidence level and the five highest cost main extensions to determine if the aggregate PI thresholds need to be adjusted on a go forward basis in order to achieve the aggregate PI of 1.1. The review is to include a comparison of forecast and actual costs; consumption; and PI for the first five years of main extensions in the sample;
2. a concise explanation of the random sampling methodology used; and
3. a comparison of the forecast and actual cost for all service line and main extension installations.

From the Companies' communication with Commission Staff and from Commission Staff's Comments letter dated April 20, 2011, the Companies understand that in terms of compliance with the above cited Directives, the Commission Staff do not take issue with items 2 and 3. The Commission Staff's issue, as the Companies understand it, is whether the Companies are in compliance with the Commission Directives by providing a yearly PI result that will be using the forecasted consumption data originally provided in year 1 of the five-year period, without incorporating year-to-date actual consumption data and without the re-forecasted consumption data for the remainder of the five-year time frame.

The Companies first want to emphasize that they take the Commission's directives very seriously and do their best to comply fully with them. Furthermore, the Companies are endeavouring to make improvements to both the format and substance of the compliance reports wherever appropriate and without violating Commission orders.

The Companies believe that they are in compliance with the Commission Directives by generating and reporting a yearly PI result using actual main extension cost data with originally forecasted consumption data for the following reasons.

First, there is no specification in the Commission Directives or the Commission's Decision that under the MX Test, "actual" consumption data must be used when determining PI. The MX Test is used to determine a PI that represents a ratio of the PV of expected revenues to the PV of expected costs. Consumption data is an input parameter for determining revenue. Additionally, the MX test examines customer attachments for a five-year period. On page 11 of the Commission's Decision dated November 6, 2007, the Commission cited the MX Test parameters provided by the Companies. Specifically with respect to the "consumption estimate" and "revenue" input parameters, the Companies provided the following:

Consumption Estimate	From Residential End Users Study
Revenue (based upon Consumption)	Specific to each utility and Rate Class. Revenues are for distribution margin only and do not include the cost of commodity.

No specific reference to or requirement of actual or forecast consumption or segmented consumption data (e.g., by rate class) is made in terms of calculation of revenue. In the Decision, the Commission clarified (1) that consumption estimates in the FEVI area should reflect use per appliance, and (2) that consumption estimates should account for consumption "ramp-up." The Commission Order did not specifically require that the yearly PI result be generated with a set of actual consumption data, nor did it specifically require the Companies to provide re-forecasted consumption data and re-run the MX Test.

Second, although in last year's report the Companies presented PI results with actual consumption data,[4] departure from a past practice does not necessarily mean that the Companies are non-compliant with a Commission order or need a variance from the Commission Directives. The Companies have not changed the PI formula or the input parameters of the MX Test as they have been approved by the Commission. Nor have the Companies failed to provide information as directed by the Commission Directives. As explained in section 3.2.2 of this Report, not only will the Companies continue to provide updated actualized consumption data for information purposes, but they will also furnish improved consumption and cost data as detailed in section 3.2.2. Additionally, the Companies will continue to present PI results in their annual report.

Third, the Companies believe that there is limited value in reporting on a re-forecasted PI value based on re-forecasting consumption for every main extension annually and then re-running the MX Tests. The accuracy of any potentially revised attachment and consumption forecasts will not necessarily be any more precise as they would be subject to the cyclical BC housing market conditions that are out of the Companies' control and difficult to predict into the future.

Lastly, the PI results using forecast consumption continue to enable the Commission to monitor the progress of the Companies' system extensions, without adding substantially to the administrative burden of administrating the MX Test. As explained in section 3.2.3 of this Report, presenting yearly PI results using re-forecasted consumption data and re-running MX Tests annually creates an undue administrative burden. Given that there are potentially 2,000 extensions on a rolling-basis, this can make the re-forecasting and re-running of the MX Tests very labour-intensive and time consuming. This argument also applies even if the Companies were to report on a random sample of the entire main extension population.

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4 The Companies note that the PI results presented in the last year's report did not incorporate re-forecast consumption data for the remainder of the five year period. The Companies' consumption data presented was based on year to date actual data plus the <u>original</u> forecast for the year to date to the year 5 time frame. Please refer to pages 17 and 18 for further explanation of this approach.

The appropriate time frame to provide the actual main extension's PI is at the end of the five year period (i.e. for 2010 main extensions this would occur in October 31, 2015; similarly, for 2008 and 2009 main extensions, actual PI will be provided following October 31, 2013 and October 31, 2014 respectively)

In sum, the Companies believe that they have complied with the Commission's Directives that request a comparison of forecast and actual costs; consumption, and PI results for the five-year horizon in the annual report. The Companies believe that the Report provides information that demonstrates the fair and equitable treatment of customers and that existing customers are not adversely affected by the addition of a new customer or customers.

2.2 2010 MX Report Overview

The Report is organized in the following manner:

a) Executive Summary:

As described earlier, this section summarizes the four key findings from the Report.

b) Introduction

This section provides the relevant regulatory history of the MX Test including a summary of how the Companies are complying with the Commission reporting requirements. This section also provides an overview of the Report.

c) Methodology

This section provides an overview of the MX Test formula and the inputs into the formula including appliance data, economic parameters and geo code pricing parameters. As well, this section will discuss the criteria used to determine manual versus geo code pricing for main extensions. Finally, this section describes the methodology used to report on main extension results.

d) BC Housing Market

This section summarizes the cyclical nature of the BC housing market and the modest return to growth of housing starts in 2010.

e) 2010 MX Test Results & 2010 VSD Results

This section provides data for the 2010 mains in aggregate and top 5 mains for both FEI and FEVI. This section reviews forecast versus actual cost, attachments, consumption and forecast PI and the decline in the number of main extensions and forecast attachments in 2010 compared to previous years. This section also provides a discussion of the 2010 VSDs.

f) 2009 MX Test Results

This section provides an update on the 2009 mains including forecast versus actual consumption.

g) <u>2008 MX Test Results</u>

This section provides an update on the 2008 mains including forecast versus actual consumption.

<u>Glossary of Terms</u>

This section provides definitions relevant to the Report.

3 METHODOLOGY

The following section provides a discussion of the methodology used to establish inputs into the 2010 MX Test as well as the methodology used to present the results of the Report. It begins with an overview of the MX Test formula and the relevant inputs followed by a description of the data used to report on main extension results.

3.1 MX Test Formula

All applications to extend the gas distribution system to one or more new customers are subject to an MX Test approved by the Commission. The primary purpose of extension and connection policies is to promote fair and equitable treatment of customers and, more specifically, to ensure that customers in existence at the beginning of the year are not adversely affected by the addition of a full year's cohort of customers. The MX Test develops a PI which is the ratio of the discounted present value of all forecast net cash inflows over twenty years divided by the discounted present value of the capital costs of attaching customers in the first five years of the main extension.

Under Order G-152-07, the Commission has approved for both FEI and FEVI that if an individual PI is 0.8 or greater, the system extension can proceed without the need for a customer contribution. If the PI is less than 0.8, a customer contribution would be required to make up the shortfall to bring the PI up to the 0.8 threshold, before the system extension can be built. In the same Order, the Commission also approved an aggregate PI of 1.1 as a threshold for the portfolio of main extensions completed on an annual basis.

Both FEI and FEVI currently use the same discounted cash flow test to evaluate main extensions; however, the inputs for the tests vary between each utility (please refer to Section 3.1.1 for a discussion on the inputs and the differences between each utility). While there are many components factored into the calculation of this ratio, the following formula provides a summary of the major components:

PI = Net Present Value of Net Cash Inflows (Delivery Margin + Connection Fees – O&M - System Improvement Charge – Property Tax – Income Tax)/Net Present Value of Capital Costs (Mains, Services, Meter Costs)

A discussion of the net cash inflow, capital cost and discount rate inputs into the MX Test formula follows. Throughout the Report, the Companies provide the requisite level of discussion of the variance from previous year's data.

3.1.1 NET CASH INFLOWS

Net cash inflows are composed of the delivery margin plus connection fees, less O&M, a system improvement charge, property tax, and income tax. Each of these components is discussed below.

The projected delivery margin used in the economic test is determined by

(a) estimating the number of customers to be served by the main extension;

(b) establishing consumption estimates for each customer;

(c) projecting when the customer will be connected to the main extension; and

(d) applying the appropriate delivery margin for each customer's consumption.

The delivery margin projection takes into consideration the estimated number and type of gas appliances used. Customers who intend to install both high efficiency gas fired space (namely an Energy Star rated furnace or boiler) and water heating appliances (tankless water heaters, or water heaters with an efficiency rating of 78 percent or greater) receive a credit of 10 percent of the volume otherwise used for both appliances. Customers who intend to install both high efficiency gas fired space and water heating appliances and attain a minimum of LEED™ (Leadership in Energy and Environmental Design) General Certification receive a credit of 15 percent of the volume otherwise used for both. In addition, the projected revenue from application fees is included in net cash inflows. Only those customers expected to connect to the main extension within 5 Years of its completion are considered.

In order to determine consumption estimates for each customer, the Companies use annual usage estimates by appliance type. The usage per appliance data used in the MX Test to determine projected delivery margin is presented in the following table:

Table 2: Appliance Use Inputs for MX Test

	2009 & 2010 (GJ/yr)	2011 (GJ/yr)		
Appliance	All Regions	Lower Mainland	Interior	Vancouver Island
Barbeque	3.1	3.1	3.1	3.1
Boiler	60.0	62.0	51.6	43.0
Clothes Dryer	4.0	4.2	3.6	3.4
Fireplace - Décor	16.8	21.4	19.8	19.7
Fireplace - Heating	15.8	18.3	15.9	16.1
Furnace (primary)	60.0	62.0	51.6	43.0
Furance (secondary)	60.0	18.1	39.3	19.9
Hot Tub	17.9	19.5	19.5	19.5
Hot Water Tank	20.8	20.4	18.8	18.8
Pool	53.5	38.5	38.5	38.5
Range/Cooktop	8.5	5.6	5.1	4.7
Wall Heater	18.1	7.1	7.1	7.1

The Companies use data from internal residential end use studies and operational experience as the basis for updating appliance usage. As seen in the table above, in 2011 the Companies introduced changes whereby usage is segmented by region and updated as per the 2008 Residential End Use Study ("REUS"). These changes were made to improve the accuracy of forecasting appliance usage and subsequently improve consumption forecasting.

The basic and delivery charges, the in lieu rate and new service fee data are as follows:

Table 3: Basic & Delivery Charges, In Lieu Rate & New Service Fee

	2009				2010			
Rate Class	Basic Charge ($/yr)	Delivery Charge ($/GJ)	In Lieu Rate (%)	New Service Fee ($)	Basic Charge ($/yr)	Delivery Charge ($/GJ)	In Lieu Rate (%)	New Service Fee ($)
FEI								
Rate 1	$143.88	$3.00	2.97%	$85.00	$142.08	$3.18	2.55%	$25.00
Rate 2	$301.80	$2.51	3.70%	$85.00	$298.08	$2.64	3.11%	$25.00
Rate 3/23	$1,610.40	$2.16	3.36%	$85.00	$1,590.24	$2.26	2.87%	$25.00
FEVI								
RGS	$126.00	$4.49	2.08%	$85.00	$126.00	$7.69	2.84%	$25.00
SCS-1	$113.40	$7.10	1.87%	$85.00	$113.40	$10.30	2.40%	$25.00
SCS-2	$402.36	$6.62	1.93%	$85.00	$402.36	$9.82	2.55%	$25.00
LCS-1	$732.00	$3.51	2.54%	$85.00	$732.00	$6.71	4.15%	$25.00
LCS-2	$1,173.84	$2.47	3.02%	$85.00	$1,173.84	$5.67	6.22%	$25.00
LCS-3	$2,418.12	$2.18	3.39%	$85.00	$2,418.12	$5.38	8.47%	$25.00
AGS	$480.00	$2.53	3.06%	$85.00	$480.00	$5.73	6.23%	$25.00

The basic charge revenue used in the main extension test is the annual sum of the basic monthly charge. The delivery charges used in the main extension test are applied to the forecasted consumption for all respective rate classes. In the case of FEVI, an effective delivery margin is calculated by subtracting the unit cost of gas from the sales rate. The FEVI sales rate remained at the same level for 2009 and 2010. The change in the derived delivery rate results from a change in the unit cost of gas.[5] The basic charge and delivery charge updates for 2010 are based on the approved tariff on January 1, 2010 per respective rate classes for FEI[6] and

[5] In 2010, the unit cost of gas includes royalty credits. Including the royalty credits in the cost of gas results in a derived delivery rate that more closely resembles the gross margin of FEVI

[6] FEI Basic and Delivery Charges – "Terasen Gas Inc. General Terms and Conditions, Rate Schedule 1, twelfth revision of page R.1.1; Rate Schedule 2, Rate Schedule 1 (pg. R-1.1); Rate Schedule 2, twelfth revision of page R-2.1; Rate Schedule 3, twelfth revision of page R-3.1.)"

FEVI[7]. The Companies are required to collect 1% of revenues and remit it to local governments. Since the MX Test model uses only the delivery-related portion of the rates, the in lieu rates scale up for the total rate relative to the delivery portion of the rate only.

The new service fee for main extensions reflects the value found in each Company's respective tariff.[8]

The net cash inflows portion of the MX Test formula includes economic parameter inputs used for all rate classes. The relevant parameters are summarized below:

Table 4: Net Cash Inflows Economic Parameters[9]

	FEI			FEVI		
Economic Parameter	**2009**	**2010**	**2011**	**2009**	**2010**	**2011**
O&M per Customer						
Residential	$75.00	$75.00	$86.00	$62.48	$62.48	$70.00
Commercial	$98.00	$98.00	$89.00	$86.48	$86.48	$85.00
System Improvement (SI)	$0.16	$0.16	$0.16	$0.15	$0.15	$0.15
Property Tax Rate	1.85%	1.96%	1.95%	1.71%	1.81%	1.86%
Income Tax Rate	30.00%	28.50%	26.50%	30.00%	28.50%	26.50%

As seen above, in 2011[10] the Companies updated the O&M per customer figures to reflect data available from the 2010-2011 Revenue Requirement Applications ("RRAs").[11] The O&M updates have been developed following a similar methodology as in the past, where applicable costs related to servicing a new gas customer (i.e. Distribution Operations Support, Customer Management and Support) are allocated to the respective customer classes using two primary cost drivers: the number of customers in each rate class and peak day factors representative of Distribution system capacity related costs. The resulting proposed rates are generally higher than in the past driven by the higher level of O&M funding approved with the RRAs.[12] The next window for updating the assumptions again would be on approval of the next RRA.

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7 FEVI Basic and Delivery Charges – "Terasen Gas (Vancouver Island) Inc., Standard Terms and Conditions and Rates for Gas Service, seventh revision of page C-2 to C-7 and page C-11".

8 FEI New Service Fees – "Terasen Gas Inc. General Terms and Conditions, Third revision of page S-1) as per Commission order no: G-141-09." FEVI New Service Fees – "Gas (Vancouver Island) Inc., Standard Terms and Conditions and Rates for Gas Service", third revision of page C-1 as per Commission order G-140-09.

9 For this table, FEI Commercial is defined as Rate Schedule 2 and FEVI Commercial applies to all sales customers excluding Residential (RGS)

10 2011 data has been provided for informational purposes only, the data does not apply to the 2010 Main Extensions, the parameters will be used in the 2011 Main Extension Portfolio

11 *Terasen Gas Inc 2010 and 2011 Revenue Requirements and Delivery Rates Application (Commissions approval order G-141-9) and Terasen Gas (Vancouver Island) Inc. 2010 and 2011 Revenue Requirements, Rates, Cost of Service, Rate Design and Revenue Deficiency Deferral Account Balance Application (Commission approval order G-140-09)*

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Also shown in Table 4, system improvement[13] remains unchanged (while property tax rates are based on actual property tax payments. The changes in income tax rates reflect those included in the RRAs.[14]

3.1.1.1 Consumption Ramp Up

As per Commission Order Nos. G-152-07 and G-6-08, the Companies confirm that they do reflect the fact that larger developments may require several years before all units are occupied and normal consumption patterns are established in the MX Test inputs.

Various considerations go into the forecast consumption of the MX Test to reflect "ramp up" such as economic conditions, project forecasts from builder/developers and the Companies' expertise and experience in these areas.

3.1.2 CAPITAL COSTS

The total cost to be used in the economic test includes, without limitation:

(a) The full labour, material, and other costs necessary to serve the new customers including mains, service lines, meter sets and any related facilities such as pressure reducing stations and pipelines;

(b) The appropriate allocation of the Companies' overheads associated with the construction of the main extension;

(c) The incremental operating and maintenance expenses necessary to serve the customers; and

(d) An allocation of system improvement costs.

Points (a) and (b) are discussed in the following section while points (c) and (d) were addressed in the Net Cash Inflows section.

Geo code and manual estimate pricing are the two methods used to determine main extension costs. Geo code pricing refers to a unit cost methodology which is based upon the geographical region, typical ground conditions and length of service to be installed. The purpose of using geo code estimates is to provide an efficient and unbiased approach that produces reasonable variance results for the Companies to estimate the costs of hundreds of main extensions

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[13] The purpose of the System Improvement charge is to allocate the cost of system improvements on the distribution system that result from increases to system capacity. The System Improvement charge uses a five year forecast of system improvement costs and the growth in peak day over that period. The Companies believe that a five year time frame is appropriate for determining a System Improvement charge over the time period. The current System Improvement charge was calculated in 2007, and therefore, no changes have been made as the time period is within the five year period. The next System Improvement assessment will take place in 2012.

[14] Terasen Gas Inc 2010 and 2011 Revenue Requirements and Delivery Rates Application (Commissions approval order G-141-9) and Terasen Gas (Vancouver Island) Inc. 2010 and 2011 Revenue Requirements, Rates, Cost of Service, Rate Design and Revenue Deficiency Deferral Account Balance Application (Commission approval order G-140-09)

annually. Geo code values are derived using linear regression performed on historical main extension cost data.

For a small percentage of main extensions (approximately 10%), the geo code pricing methodology is not the most appropriate estimating method due to unique site specific requirements. In these circumstances, manual estimates are used. The following table illustrates the criteria used by the Companies to determine the requirement to use geo code versus manual estimates.

Table 5: Geo Code & Manual Estimates Criteria

Pipeline Criteria	Geo Code	Manual Estimate
Pressure	Distribution pressure (DP)	Intermediate pressure (IP)
Material	Ployetheleyne (PE)	Steel (ST)
Diameter	Up to 60 mm (2")	88mm (3.5") and larger for PE and ST
Length	Maximum 1000m	Greater than 1000m
Cost	Maximum $100,000	Greater than $100,000
Crossing Type	Road or pipeline only	Directional drills, highway, bridge, water or railway crossing
Environmental impacts	All envirnonmental impacts except fish bearing streams	Environmental impact of fish bearing streams
Other		Vertical Sub Divisions
		Conversion Mains
		Mains in transmission right of ways

For those main extensions where manual estimating is determined to be appropriate, the person responsible for developing the cost estimate of the project (the "Planner") uses information contained in the construction services contract with the Companies' service provider. In other words, the Planner uses the same criteria for cost projections as those actually performing the construction of these projects. In addition to the development of the criteria above, the Companies have also introduced more site visits to confirm site requirements, additional controls and management oversight of cost estimates. All Planners responsible for providing cost inputs receive the requisite training that includes an estimating manual complete with sample cases.

Recent geo codes measured in $ per metre ($/M) and manual estimate inputs used in the MX Test are as follows:

Table 6: Geo code & manual estimate parameters

Geo code & manual pricing ($/Metre)							
		PE Pipe ($/m)			Steel Pipe ($/m)		
Year	Zone	Up to 60 mm	88 - 114 mm	168 mm	Up to 60 mm	88 - 114 mm	168 mm
2010							
	Vancouver & Richmond	$83	$141	$227	$208	$353	$566
	North Shore & Squamish	$55	$94	$150	$138	$234	$375
	North of Fraser River	$56	$95	$153	$140	$238	$382
	South of Fraser River	$47	$80	$128	$118	$200	$321
	Interior North	$35	$60	$96	$88	$149	$239
	Interior South	$26	$44	$71	$65	$111	$177
	Vancouver Island	Manual	Manual	Manual	Manual	Manual	Manual
2009							
	Vancouver & Richmond	$59	$84	$162	$148	$211	$405
	North Shore & Squamish	$54	$77	$148	$136	$192	$370
	North of Fraser River	$62	$88	$169	$154	$219	$422
	South of Fraser River	$40	$56	$108	$99	$140	$270
	Interior North	$27	$39	$74	$68	$96	$185
	Interior South	$28	$40	$77	$71	$101	$193
	Vancouver Island	$61	$87	$167	$153	$218	$419

In the table above, “manual” refers to how the Companies introduced manual pricing for that particular type of main extension in 2010. The practice of using manual pricing for main extension cost estimating was introduced to FEVI on a pilot basis in 2010. The process was introduced to FEI in the latter part of 2010.

The variance in values seen in the table above relates to the use of linear regression on historical main extension cost data as the basis for geo code estimates. In Vancouver and Richmond for example, the actual main extension costs in that area have risen since 2009 due to the higher costs of installing mains in a developed, urban environment; consequently, the geo code input rose as well.

The capital cost portion of the MX Test formula includes economic parameter inputs used for all rate classes. The relevant parameters are summarized below:

Table 7: Capital Cost Economic Parameters

	FEI			FEVI		
Economic Parameter	2009	2010	2011	2009	2010	2011
Overhead Rate	32.00%	32.00%	30.00%	32.00%	32.00%	30.00%
CCA Class 1	6.00%	6.00%	6.00%	6.00%	6.00%	6.00%
Working Capital Rate	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%

As seen above, in 2011[15] the Companies updated the applicable overhead figures to reflect data available from the RRAs.[16] This overhead rate represents applicable costs required in support of new mains activities and is reflective of the Companies current cost structure and overhead capitalization

3.1.3 DISCOUNT RATE

The discount rates used for 2009 and 2010 are 4.2% and 5.1% for FEI and 4.3% and 4.7% for FEVI respectively. The discount rates reflect the capital structure of each company and the relative borrowing costs and allowed ROE (Commission Order No. G-158-09) as per the Companies' respective RRAs. For each year, the discount rates were adjusted to real dollars using an inflation factor of 2%.

3.2 Reporting of 2010 Main Extension Data

As will be seen in the following section, the methodology followed by the Companies in reporting annual MX Test results is consistent with the principle of having economic new main extensions that ensure that existing customers are not adversely affected by the addition of a new customer or customers.

3.2.1 MAIN EXTENSIONS INCLUDED IN DATA SET

The aggregate data set for the 2010 main extensions was determined based on the following criteria.

1. All main segments within the MX test that were installed after November 1, 2009.
2. All completed main segments that were technically complete prior to October 31, 2010.

In the Report, the Companies are reporting on the entire 2010 main extension population as the basis of the random sample. By reporting on the results of all the annual main extensions, the Companies are ensuring the information presented to the Commission is as comprehensive and accurate as possible. The Companies also present a data set comprised of the top five main extensions for each utility based on actual costs.

In the Report, the Companies are diverging from the sampling methodology followed in 2008 and 2009 whereby main extension data was presented specific to the year in question. In 2010, the Companies will also report separately on results from 2008 and 2009 main extensions. The reporting for 2008 and 2009 main extensions will also be based on the entire main extension

[15] 2011 data has been provided for informational purposes only, the data does not apply to the 2010 Main Extensions, the parameters will be used in the 2011 Main Extension Portfolio

[16] Terasen Gas Inc 2010 and 2011 Revenue Requirements and Delivery Rates Application (Commissions approval order G-141-9) and Terasen Gas (Vancouver Island) Inc. 2010 and 2011 Revenue Requirements, Rates, Cost of Service, Rate Design and Revenue Deficiency Deferral Account Balance Application (Commission approval order G-140-09)

population. Going forward, historical main extensions will be reported on until the end of the five year period, for example, through to October 31, 2013 for 2008 projects. This improvement in reporting by tracking historical mains over five years exceeds the requirements set forth in Commission Orders G-152-07 and G-6-08 and is expected to provide additional insight into the results of historical main extensions.

3.2.2 COST AND CONSUMPTION

In this section, the Companies discuss the forecast versus actual costs, consumption, the PI for the first five years of main extensions in each Companies' portfolio, and the five highest cost main extensions. The Companies have made a number of improvements to the Report that are outlined below and are expected to provide greater insight to the Commission over the five year period of main extension projects.

The Companies have made cost reporting improvements in 2010 by reporting on the main extension, service line and meter costs over the five year period and over the time frame in question. For example, for 2009 main extensions, the Companies will report on forecast versus actual costs incurred over the two years since the 2009 main extensions were complete as well as the forecast costs over the five year period. Actual costs for the five year period will be provided at the end of the five year period. Cost reporting will be provided for 2010, 2009 and 2008 main extensions. Previously, the Companies reported on main extension costs for the year in question only.

The Companies have made consumption reporting improvements in 2010 by segmenting consumption in terms of attachments, consumption in gigajoules ("GJ") and GJ per attachment. Consumption is further segmented by the forecast total over years 1- 5, the forecast up to the current year and the actual year to date results. Detailed notes accompany each table describing the data presented is also provided.

Actual 2010 year to date consumption data will be provided for information purposes only and is not necessarily indicative of consumption patterns, due to a lag time effect. For example, a main extension technically complete on October 31, 2010 would have a year 1 forecast attachment date of October 31, 2011, one year from the technically complete date. In comparison, the cut off for the actual year to date attachments is March 1, 2011 when the Companies pulled the data for reporting purposes to the Commission. In this hypothetical example, there is an eight month lag time effect between the year 1 forecast and the year to date actual results. The appropriate time frame to evaluate 2010 consumption results will be in 2011 and subsequent years when the effect of the lag time will have diminished. The 2008 and 2009 MX Test Results sections present results that are more indicative of consumption patterns as the lag time effect is not as significant as in the current year.

The Companies factor in rate class considerations when making consumption forecasts as a part of the MX Test. However, the Companies are not able to report on consumption data segmented by rate class given the current resources available as it would create an undue administrative burden, and this level of detail exceeds the Commission compliance requirements noted in Table 1.

3.2.3 PROFITABILITY INDEX

The Companies have also made PI reporting improvements in 2010. The Companies are reporting a forecast PI for the first five years of main extensions in the sample as well as providing a forecast PI over the same time frame using actual main extension costs and forecast consumption, service line and meter costs. The appropriate time frame to provide the actual 2010 main extensions PI will be at the end of the five year period (i.e. October 31, 2015). Similarly, for 2008 and 2009 main extensions, actual PI will be provided following October 31, 2013 and October 31, 2014 respectively. The actual PI at the end of the respective five year periods will reflect all relevant consumption and main extension, service line and meter cost data.

As will be described in the BC Housing Market section, the BC housing market has been highly cyclical in the recent past as seen by the bullish conditions from 2006-2007 contrasted with the bearish conditions from 2008-2009. For this reason, it is appropriate to look at aggregate main extension PIs over a five year time horizon, not using one year of results in isolation. By taking this longer term view, the actual PI results will factor in the realities of the ups and downs of the BC housing market as opposed to assessing short term results in a myopic and potentially reactionary manner.

Providing a forecast PI using actual costs and the forecast consumption that was used in the MX Test is a departure from the reporting methodology followed in 2008 and 2009. In those years, the Companies presented forecast PI values based on actual costs and consumption based on year to date actual data plus the original forecast for the year to date to the year 5 timeframe.

For example, in the hypothetical main extension project below, the consumption forecast was 10 attachments per year over five years, and, the year to date actual attachments for year 1 was zero. The 2008-2009 PI method would have used 40 attachments in the re- forecasted PI.

	Forecast Attachments	YTD Actual Attachments
Year 1	10	0
Year 2	10	10
Year 3	10	10
Year 4	10	10
Year 5	10	10
Total	50	40

The methodology used in 2008 and 2009 presented an unrealistically negative picture of MX Test results because it did not account for the possibility that consumption that did not materialize as forecast in year 1 might show up at some later point in the five year timeframe (i.e. 10 attachments in the hypothetical example). Delayed attachments are a particularly salient issue during a bearish period such as 2009 because the delayed attachments tend to rebound along with the BC housing market. For example, as will be seen in the 2008 and 2009 results, the delayed attachments from 2009 have generally materialized in 2010.

The Companies are proposing to provide a forecast PI based on actual main extension costs and the original forecast consumption, service line and meter costs. And, actual main extension PI values will be provided at the end of the five year period using actual consumption data. The Companies will not, in the interim, be annually re-forecasting consumption for individual main extension projects and then subsequently re-running individual MX Tests to develop re-forecasted PI values. The Companies believe that there is limited value in reporting on a re-forecasted PI value based on re-forecasting consumption for every main extension annually and then re-running the MX Tests. There are two main reasons for this:

- First, re-forecasting attachment and consumption data for hundreds of main extensions each year would be impractical and create an undue administrative burden. If the Companies were to adopt this practice, the Companies could be in the position of re-running thousands of main extension tests at the end of a five year period resulting in the need to hire at least one additional full time employee.
- Second, the accuracy of any potential, revised attachment and consumption forecasts would still be variable as they would be subject to the cyclical BC housing market conditions which are out of the Companies' control and difficult to predict into the future, as described in Section 4.

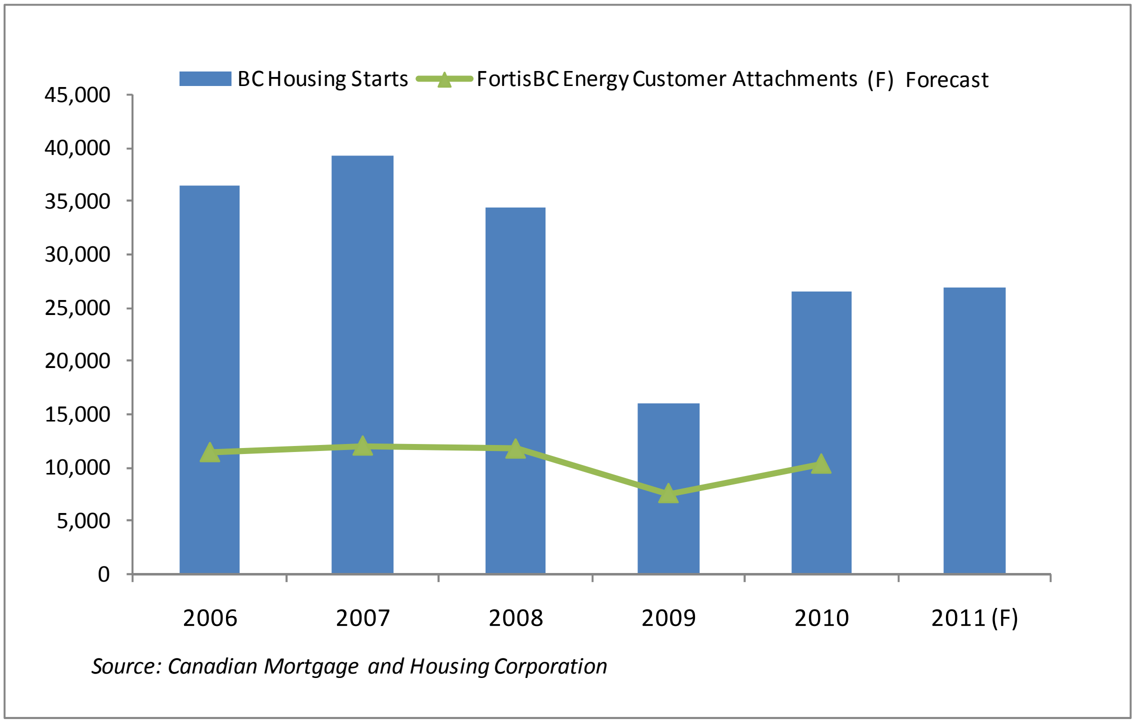
Consequently, re-forecasting load annually and re-running MX Tests would provide limited added value to the Commission's MX Test review while adding substantively to the Companies' administrative workload, resulting in additional costs for customers. The appropriate time to provide actual main extension PI values with actual consumption data is at the end of five-year period.

In sum, the Companies have demonstrated compliance with respect to reporting on MX Test parameters. And, the Companies have improved reporting in 2010 by providing 2008-2009 main extension project updates, enhanced cost reporting, greater segmentation of consumption data and a PI forecast that is as accurate as possible without adding substantially to the Companies' administrative workload. These improvements are expected to provide greater insight for the Commission over the five year review period of main extension projects.

4 BC HOUSING MARKET

The BC housing market and the Companies' consumption results are closely related. Both the BC housing market and the Companies' customer attachments have been highly cyclical in the recent past, as seen in the figure below. The return to growth in 2010 from the bearish years starting in 2008 will be discussed in the following section and used as an example to support the Companies' position that it is prudent to take a longer term view when evaluating PI results rather than taking a limited, one year horizon.

Figure 1: BC Housing Starts & the Companies' Customer Attachments



2008 marked BC's first decline in GDP since 1982 and it was also the first time since 2001 that the BC economy grew more slowly than the Canadian average.[17] GDP fell even further in the first half of 2009. Job losses during this period translated to reduced domestic demand for goods and services, and reduced consumer spending. BC's resource-based exports were also significantly lower with the forestry sector being the hardest hit due to the housing slowdown of its largest customer, the US. The fall of the US dollar against the Canadian dollar posed an added challenge to BC forestry and other commodity companies as well. Developers reacted to these market indicators, as housing starts fell somewhat in 2008 and more dramatically in 2009. The less than optimal MX Test results reported in 2009[18] were attributable to the economic

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17 BC Ministry of Labour and Citizen Services, BC Stats Business Indicators, April 2009

18 TGI and TGVI Main Extension Report and TGI Revised Vertical Subdivision Report for Year End, submitted August 18, 2010

downturn that resulted in multifamily projects and developments being put on hold and fewer customers attaching to main extensions than forecast.

Results in the Report will show that the 2009 MX Test report[19] appropriately indicated that with the economy returning to growth, building developments would restart and in turn attachment and consumption results would improve in future years.

By 2010, low mortgage rates, improved financial markets and consumer spending helped provide renewed confidence to investors and consumers and an impetus for buyers to return to the housing market. The impending arrival of the HST on July 1st 2010 together with tax relief rebates also encouraged home sales, as buyers sought to avoid the increase in the purchase price of a new home, renovation of an existing home and closing costs (commission, legal fees, inspections, etc.) associated with the HST. Developers responded to this demand with increased housing starts in the first half of 2010 before tapering off for the rest of the year. This decline is partly attributed to the HST, given the experience of other regions like the Maritimes that already have HST and experienced a 2,000 unit decrease in housing starts following harmonization[20].

Economic growth is expected to grow at a similar pace as 2010 with BC's GDP at 3.1% for 2011. Housing starts are forecast to grow slightly with a forecast of 26,900 starts in 2011[21] and the Companies' customer attachments are expected to follow this trend as well. However, several factors could adversely affect the number of housing starts, including higher home prices from the HST, higher interest rates and new mortgage rules.

Inevitably there will be uncertainty and variability inherent in forecasting housing attachments, despite the Companies' best efforts to apply their industry knowledge, experience and conservative approach to forecasting. Given the highly cyclical nature of the BC housing market such as the period recently observed, and the uncertainty in forecasting housing attachments, it is appropriate to review MX Test results over a longer period such as the five year period as approved by the Commission.

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19 IBID
20 B.C. Ministry of Finance, New Housing Rebates and Transitional Rules for British Columbia HST, November 18, 2009
21 Canada Mortgage and Housing Corporation, Housing Market Outlook, British Columbia Region Highlights - Economic Outlook, First Quarter 2011.

5 2010 MAIN EXTENSIONS & VERTICAL SUBDIVISIONS

The following section summarizes the results for 2010 main extensions. As discussed in the Methodology section, the results from both the aggregate and top 5 main extensions will be reviewed. For 2010, there were no vertical subdivisions.

5.1 2010 Main Extensions

In 2010, the Companies re-aligned sales efforts and designated a specific territory for each sales person to improve the actual attachments and consumption data at the end of any given five year period. This allowed for greater focus and a closer working relationship with Planners, municipal governments and developers as projects evolve. In 2010, every main extension had a Planner and sales manager assigned to the project to evaluate, implement and monitor over the five year horizon. Furthermore, for historical main extensions such as the 2008 and 2009 installations, sales managers are responsible for monitoring the consumption and following up with builder/developers as required.

The table below summarizes the aggregate 2010 main extension results along with notes explaining the data provided. The results below refer to the entire main extension population of 205 and 106 installations for FEI and FEVI respectively.

Table 8: 2010 Aggregate Main Extensions

Utility	Cost ($)			Attachments			Consumption (GJ)			Consumption (GJ/Attachment)			PI	
	Years 1-5 Forecast	Year 1 Forecast	YTD Actual	Years 1-5 Forecast	Year 1 Forecast	YTD Actual	Years 1-5 Forecast	Year 1 Forecast	YTD Actual	Years 1-5 Forecast	Year 1 Forecast	YTD Actual	Years 1-5 Forecast	Years 1-5 Forecast, Actual Main Cost
FEI	$6,212,805	$4,673,000	$ 4,461,177	3,156	1,649	1,151	547,661	335,945	72,874	174	204	63	1.6	1.8
FEVI	$2,060,741	$1,820,857	$ 1,352,772	1,070	758	321	78,238	60,910	18,928	73	80	59	2.1	2.5

Notes:

Cost ($)	
Years 1-5 forecast	Estimated main extension, service line and meter costs at the end of year 5.
Year 1 forecast	Estimated main extension, service line & meter costs at the end of year 1.
YTD Actual	Actual main extension, service line & meter costs for the period November 1, 2009-March 1, 2011
Attachments	
Year 1-5 forecast	Forecast main extension attachments at the end of year 5.
Year 1 forecast	Forecast main extension attachments at the end of year 1
YTD Actual	Actual attachments for the period November 1, 2009-March 1, 2011.
Consumption (GJ)	
Year 1-5 forecast	Forecast main extension conumption at the end of year 5.
Year 1 forecast	Forecast main extension consumption at the end of year 1.
YTD Actual	Actual consumption for the period November 1, 2009-March 1, 2011.
Consumption (GJ/Attachments)	
Year 1-5 forecast	Forecast main extension conumption at the end of year 5.
Year 1 forecast	Forecast main extension consumption at the end of year 1.
YTD Actual	Actual consumption for the period November 1, 2009-March 1, 2011.
PI	
Year 1-5 forecast	Forecast main extension PI.
forecast, Actual Cost	Forecast main extension PI using actual main extension costs, forecast service line and meter costs and forecast consumption.

For clarification purposes, the Year 1-5 forecast refers to the cumulative total at the end of the five year period. Similarly, Year 1 refers to the cumulative total at the end of year one of the five year period. For example, the 2010 Years 1-5 forecast attachments are 3,156 representing the attachments at the end of year 5. The Year 1 forecast attachments are 1,649 meaning that during Years 2-5, 1,507 (3,156-1,649) incremental attachments are forecast to be added.

The YTD actual refers to the period from November 1, 2009 to March 1, 2011 when the data for the Report was obtained. It is not possible for the Companies to match the time period for Year 1 and YTD given the current resources available.

The Consumption in GJ/attachment is derived by dividing consumption in GJ by attachments.

The actual main extension costs compared to forecast costs are $0.1 million and $0.2 million lower for FEI and FEVI respectively. In comparison, the actual main extension costs are $2.8 million and $0.9 million for FEI and FEVI. The actual main extension costs represent only 0.1% and 0.2% of FEI and FEVI's approved rate base.[22] These variances are reasonable in that they are as accurate as possible without adding substantively to the administrative workload associated with estimating main extension costs. The Companies have the internal processes and controls in place, along with the use of geo code and manual estimating, to ensure forecast costs from Planners are as accurate as possible.

Year to date attachment and consumption data for the aggregate and the top 5 main extensions is provided for information purposes only due to the lag time effect discussed in the Methodology section. Because of the lag time effect, it is not concerning that the 2010 year to date actual attachments are less than the year 1 forecast for both utilities.

The forecast PIs for both utilities is above the aggregate 1.1 threshold approved by the Commission. The forecast PI for FEI of 1.6 is comparable to the 1.7 value in 2009. The forecast PI for FEVI is higher at 2.1 in 2010 compared to 1.3 in 2009 due to a variety of factors including higher delivery margins and a rebound in the economic outlook.

All individual main extension's PIs are forecast to be equal to or greater than the 0.8 threshold approved by the Commission. 22 FEI customers and 21 FEVI customers made a contribution in aid of construction in order to reach the individual main extension PI threshold of 0.8. In aggregate, these results demonstrate that the principles of the MX Test are being upheld, whereby customers in existence at the beginning of the year are not adversely affected by the addition of a full year's cohort of customers. In fact, the addition of economical main extensions benefit existing customers, especially in an environment where the Companies are experiencing a decline in the number of main extensions, attachments and system throughput as will be discussed in the following section.

The top 5 main extensions with the highest cost for each of the utilities are summarized below. The notes from the table above apply to this table as well.

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[22] 2010 approved rate base $2.5 billion and $0.6 billion for FEI and FEVI as per Terasen Gas Inc 2010 and 2011 Revenue Requirements and Delivery Rates Application (Commissions approval order G-141-9) and Terasen Gas (Vancouver Island) Inc. 2010 and 2011 Revenue Requirements, Rates, Cost of Service, Rate Design and Revenue Deficiency Deferral Account Balance Application (Commission approval order G-140-09)

Table 9: 2010 Top 5 Cost Main Extensions

Utility	Cost ($)			Attachments			Consumption (GJ)			Consumption (GJ/Attachment)			PI
	Years 1-5 Forecast	Year 1 Forecast	YTD Actual	Years 1-5 Forecast	Year 1 Forecast	YTD Actual	Years 1-5 Forecast	Year 1 Forecast	YTD Actual	Years 1-5 Forecast	Year 1 Forecast	YTD Actual	Years 1-5 Forecast
FEI													
Gislason Ave.	$250,216	$165,736	$222,244	100	20	70	10,815	2,163	4,182	108	108	60	1.0
Whiskey Jack Dr.	$194,214	$149,099	$145,183	65	30	26	6,548	3,022	560	101	101	22	0.8
Progress Way	$169,868	$125,155	$82,930	24	3	1	11,543	1,912	59	481	637	59	1.1
Pinot Noir Dr.	$164,138	$84,220	$85,803	62	0	8	6,244	0	611	101	0	76	0.8
Highway 95A	$110,795	$78,965	$141,760	45	15	51	4,532	1,511	2,825	101	101	55	0.9
FEVI													
Norton Rd.	$82,041	$58,911	$93,303	45	15	22	3,150	1,050	383	70	70	17	1.4
Fifth St.	$39,093	$39,093	$80,350	18	18	20	9,914	9,914	8,443	551	551	422	18.4
Rosstown Rd.	$27,664	$22,539	$38,968	8	3	1	628	221	7	79	74	7	0.8
Chilco Rd.	$144,013	$102,045	$31,502	65	22	0	2,878	1,060	0	44	48	0	1.2
Riverstone Dr.	$104,099	$104,254	$49,544	45	45	15	3,150	3,150	71	70	70	5	1.2

In the top 5 cost main extensions the difference between forecast and actual main extension costs is either minimal, below or above forecast. In aggregate, the main extension costs variances for FEI and FEVI are approximately $64,000 and $34,000 below forecast respectively. Note that the Chilco Road and Riverstone Road projects have additional phases still to be completed so the YTD actual costs will come closer to forecast. All FEI and FEVI projects were done with geo code estimates, excluding Rosstown Road. The cost estimating techniques continue to provide an efficient, unbiased and reasonable means to estimate costs. The results also reflect the challenges Planners face in providing cost estimates that are as accurate as possible when environmental circumstances can be highly variable and unpredictable. An example of this is the Rosstown Road project that faced poor weather conditions and unexpected site issues.

As in the 2010 aggregate main extension data set, year to date attachment and consumption data for the top 5 main extensions is provided for information purposes only. The lag time effect has not impacted FEI's year to date attachments whereas FEVI's year to date attachments are roughly one half of forecast, similar to the aggregate data set. The Chilco Road main extension for example, was completed October 27, 2010 so attachments will lag behind the year 1 forecast. The lag time effect has affected the actual year to date consumption for both utilities.

5.1.1 DECLINE IN MAIN EXTENSIONS, ATTACHMENTS & THROUGHPUT

A concerning trend emerged in 2010 whereby the number of main extensions, the forecast attachments and the system throughput have dropped significantly. As seen in the table below, between 2008 and 2010, the following trends have been observed for the Companies:

- The number of main extensions have reduced from 492 in 2008 to 311 in 2010
- Forecast attachments decreased 47%
- Normalized system throughput dropped 4.27%[23]

[23] System throughput includes FEI and FEVI residential, commercial, industrial and transportation customers

Table 10: Declining Main Extension & Attachments in 2010

	Actual Main Extensions	Actual Cost ($ 000)		Forecast Attachments	Normalized Volumes (TJ)
	Aggregate	Aggregate	Top 5	Year 1-5	System Wide
2008	492	$ 8,434	$ 1,921	7,433	210,091
2009	376	$ 8,598	$ 3,314	6,517	200,821
2010	311	$ 3,731	$ 588	4,226	201,110

So, while 2010 represents a return to modest growth in the BC housing market and the forecast versus actual attachments presented in the Report have improved relative to 2009, the number of main extensions and attachments in the Companies' main extensions are significantly lower than 2008 levels.

The decline in the number of main extensions and attachments is partly attributable to the housing inventory left over from the recession that developers sold off first, before building new inventory. The decline is also partly attributable to the significant capital cost differential between natural gas and electricity in the heating and hot water heating applications. Feedback from our customers to sales managers indicates that builders and developers are likely to select electricity over natural gas due to the incremental capital cost of installing natural gas equipment in building a typical home if they don't believe they can recover these cost differences in the selling price of the home.

The Companies' recent submission of the Review of Price Risk Management Objectives and Hedging Strategy[24] described that the upfront cost to install a high efficiency gas furnace (90% efficiency) and associated duct work in a home is estimated to be approximately $7,000 whereas the upfront estimated cost of installing baseboard electric heating is approximately $2,500. The upfront cost to install a gas hot water heater in a home is estimated to be approximately $1,409 (including venting) whereas the upfront estimated cost of installing an electric hot water heater is approximately $973. These wide capital cost differentials coupled with the views of our customers and the decline of the number and attachments in 2010 main extensions suggest that the Companies are facing a significant challenge in generating new customer growth in terms of the heating and hot water heating segments, the cornerstones of our business.[25] The Companies will continue to monitor and report to the Commission on this trend in subsequent MX Test reports.

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[24] TGI and TGVI Review of Price Risk Management Objectives and Hedging Strategy submitted confidentially to the Commission January 27, 2011.
[25] IBID. pp. 48-49

5.2 2010 Vertical Subdivision

There are no vertical subdivision projects to report in 2010. If there were projects to report, the Companies would have reflected in the MX the fact that VSDs require several years before all units are occupied and normal consumption is established, as per the Commission "ramp up" reporting requirements.

In summary, in 2010 the MX Test promoted fair and equitable treatment of customers and avoided undue discrimination. The full year's cohort of 2010 customers did not adversely affect the customers in existence at the beginning of the year.

6 2009 MAIN EXTENSIONS

The following section summarizes the attachment and consumption results for 2009 main extensions. As discussed in the Methodology section, the results from both the aggregate and top 5 main extensions will be reviewed.

The table below summarizes the aggregate 2009 main extension results along with notes explaining the data provided. The results below refer to the entire main extension population of 265 and 111 installations for FEI and FEVI respectively.

Table 11: 2009 Aggregate Main Extensions

Name	Cost ($ 000)			Attachments			Consumption (GJ)			Consumption (GJ/Attachment)			PI	
	Years 1-5 Forecast	Years 1-2 Forecast	YTD Actual	Years 1-5 Forecast	Years 1-2 Forecast	YTD Actual	Years 1-5 Forecast	Years 1-2 Forecast	YTD Actual	Years 1-5 Forecast	Years 1-2 Forecast	YTD Actual	Years 1-5 Forecast	Years 1-5 Forecast, Actual Cost
FEI	$9,142,651	$7,168,915	$9,005,810	4,850	2,554	2,769	750,253	475,055	495,178	155	186	179	1.7	1.6
FEVI	$4,072,525	$3,586,043	$5,795,961	1,667	1,102	993	112,527	77,596	89,435	68	70	90	1.3	0.7
FEVI Excluding Shawnigan Lake	$3,136,306	$2,708,925	$3,757,568	1,474	937	905	98,967	69,321	85,498	67	74	94	1.4	1.0

Notes:	
Cost ($)	
Years 1-5 forecast	Estimated main extension, service line and meter costs at the end of year 5.
Years 1-2 forecast	Estimated main extension, service line & meter costs at the end of year 2.
YTD Actual	Actual main extension, service line & meter costs for the period November 1, 2008-March 1, 2011
Attachments	
Year 1-5 forecast	Forecast main extension attachments at the end of year 5.
Years 1-2 forecast	Forecast main extension attachments at the end of year 2.
YTD Actual	Actual attachments for the period November 1, 2008-March 1, 2011.
Consumption (GJ)	
Year 1-5 forecast	Forecast main extension conumption at the end of year 5.
Years 1-2 forecast	Forecast main extension consumption at the end of year 2.
YTD Actual	Actual consumption for the period November 1, 2008-March 1, 2011.
Consumption (GJ/Attachments)	
Year 1-5 forecast	Forecast main extension conumption at the end of year 5.
Years 1-2 forecast	Forecast main extension consumption at the end of year 2.
YTD Actual	Actual consumption for the period November 1, 2008-March 1, 2011.
PI	
Year 1-5 forecast	Forecast main extension PI.
Year 1-5 forecast, Actual Cost	Forecast main extension PI using actual main extension costs, forecast service line and meter costs and forecast consumption.

The main extension cost variance has been reviewed in a previous report filed to the Commission[26]. The variance between Years 1-2 forecast and YTD actual costs is attributable to a combination of variance in costs and attachments.

Actual year to date attachment and consumption data relative to forecast is reasonable for 2009 main extensions. For example, FEI's year to date attachments exceed the years 1-2 forecast. These results reflect a combination of the Companies' on-going efforts to secure economic customer attachments, the improved BC housing market conditions in 2010 and the diminishment of the lag time effect discussed in the 2010 Main Extension section. The positive

[26] TGI & TGVI Main Extension Report and TGI and Revised Vertical Subdivision Report for 2009 Year End, submitted to the Commission August 18, 2010.

results for 2009 main extensions support the position that a longer term view must be taken with respect to establishing actual PI values as opposed to an isolated, one year horizon.

The forecast PI of 1.6 for FEI is above the aggregate 1.1 threshold approved by the Commission. The forecast PI for FEVI is 0.7, and 1.0 if Shawnigan Lake is removed. FEVI believes that the cost estimating issues regarding Shawnigan Lake have been addressed and are unlikely to occur in the future. Thus, the forecast 1.0 PI is more indicative of 2009 FEVI results. 26 FEI customers and 17 FEVI customers made a contribution in aid of construction in order to reach the individual main extension PI threshold of 0.8.

The top 5 cost main extensions for both utilities are summarized below. The notes from the table above apply to this table as well.

Table 12: 2009 Top 5 Cost Main Extensions

Utility	Cost ($ 000)			Attachments			Consumption (GJ)			Consumption (GJ/Attachment)			PI
	Years 1-5 Forecast	Years 1-2 Forecast	YTD Actual	Years 1-5 Forecast	Years 1-2 Forecast	YTD Actual	Years 1-5 Forecast	Years 1-2 Forecast	YTD Actual	Years 1-5 Forecast	Years 1-2 Forecast	YTD Actual	Years 1-5 Forecast
FEI													
Tronson Road	$500,549	$412,524	$263,350	205	100	6	24,100	0	63	118	0	10	0.9
2nd Avenue	$548,442	$333,756	$300,291	306	114	82	29,733	4,685	1,768	97	41	22	1.3
Upper Hyde Creek	$186,765	$184,580	$228,944	115	115	86	13,161	13,161	7,275	114	114	85	1.5
108 Avenue	$168,699	$119,457	$155,710	78	30	40	8,699	1,638	2,629	112	55	66	1.0
S of University Way	$211,465	$184,732	$99,027	78	1	1	10,489	0	995	134	0	995	0.8
FEVI													
Shawnigan Lake	$936,219	$823,750	$2,052,520	193	193	88	9,914	7,044	3,135	51	36	36	0.9
West Coast Road	$410,472	$460,287	$401,092	201	201	0	14,070	14,070	0	70	70	0	1.6
Wild Ridge Way	$91,923	$90,707	$174,513	64	64	40	4,480	4,480	1,576	70	70	39	1.9
Hammond Bay Road	$164,340	$114,580	$99,572	80	40	13	4,262	1,400	305	53	35	23	1.2
Kettle Creek Station	$114,424	$76,918	$93,406	58	20	15	5,067	1,747	322	87	87	21	1.7

Although the 2009 attachment and consumption results have improved relative to the results presented to the Commission in 2009, the Companies will continue to work with developers on specific projects to explore ways to improve attachment and consumption results where warranted.

As a result of discussions with Commission Staff, on November 2, 2010, FEVI filed the TGVI Shawnigan Lake Main Extension Report with the Commission which included comprehensive data, analysis and discussion regarding this project. Since a limited time period has passed since filing this report, FEVI intends to provide an update on the Shawnigan Lake main extension project in the 2011 MX Test year end report.

In summary, for 2009 main extensions the MX Test promoted the fair and equitable treatment of customers and avoided undue discrimination. The full year's cohort of 2009 customers did not adversely affect the customers in existence at the beginning of the year.

7 2008 MAIN EXTENSIONS

The following section summarizes the attachment and consumption results for 2008 main extensions. As discussed in the Methodology section, the results from both the aggregate and top 5 main extensions will be reviewed.

The table below summarizes the aggregate 2008 main extension results along with notes explaining the various sections. The results below refer to the entire main extension population of 305 and 107 installations for FEI and FEVI respectively.

Table 13: 2008 Aggregate Main Extensions

Utility	Cost ($ 000)			Attachments			Consumption (GJ)			Consumption (GJ/Attachment)			PI	
	Years 1-5 Forecast	Years 1-3 Forecast	YTD Actual	Years 1-5 Forecast	Years 1-3 Forecast	YTD Actual	Years 1-5 Forecast	Years 1-3 Forecast	YTD Actual	Years 1-5 Forecast	Years 1-3 Forecast	YTD Actual	Years 1-5 Forecast	Years 1-5 Forecast, Actual Cost
FEI	$ 15,198,096	$13,417,466	$ 11,133,650	5,436	4,498	4,274	680,095	583,389	551,681	125	130	129	1.3	1.2
FEVI	$ 7,848,502	$ 7,515,441	$ 5,595,532	1,997	1,865	1,859	159,679	148,818	148,193	80	80	80	1.6	1.4

Notes:	
Cost ($)	
Years 1-5 forecast	Estimated main extension, service line and meter costs at the end of year 5.
Years 1-3 forecast	Estimated main extension, service line & meter costs at the end of year 3.
YTD Actual	Actual main extension, service line & meter costs for the period November 1, 2007-March 1, 2011
Attachments	
Year 1-5 forecast	Forecast main extension attachments at the end of year 5.
Years 1-3 forecast	Forecast main extension attachments at the end of year 3.
YTD Actual	Actual attachments for the period November 1, 2007-March 1, 2011.
Consumption (GJ)	
Year 1-5 forecast	Forecast main extension conumption at the end of year 5.
Years 1-3 forecast	Forecast main extension consumption at the end of year 3.
YTD Actual	Actual consumption for the period November 1, 2007-March 1, 2011.
Consumption (GJ/Attachments)	
Year 1-5 forecast	Forecast main extension conumption at the end of year 5.
Years 1-3 forecast	Forecast main extension consumption at the end of year 3.
YTD Actual	Actual consumption for the period November 1, 2007-March 1, 2011.
PI	
Year 1-5 forecast	Forecast main extension PI.
Year 1-5 forecast, Actual Cost	Forecast main extension PI using actual main extension costs, forecast service line and meter costs and forecast consumption.

The cost variance has been reviewed in a previous report filed to the Commission[27] and the historical results are presented above.

Actual year to date attachment and consumption data compared to forecast is reasonable for 2008 main extensions. Both FEI and FEVI's year to date attachments are comparable to the years 1-3 forecast. Similar to the 2009 MX Test results, the 2008 results reflect a combination of the Companies' on-going efforts to secure economic customer attachments, the improved BC housing market conditions in 2010 and the diminishment of the lag time effect discussed in the 2010 Main Extension section. The positive results for 2008 main extensions support the position that a longer term view must be taken with respect to establishing actual PI values as opposed to an isolated, one year horizon.

[27] TGI & TGVI Main Extension Report and TGI and Revised Vertical Subdivision Report for 2008 Year End, submitted to the Commission April 3, 2009.

The forecast PIs of 1.2 and 1.4 for both utilities are above the aggregate 1.1 threshold approved by the Commission. 23 FEI customers and 24 FEVI customers made a contribution in aid of construction in order to reach the individual main extension PI threshold of 0.8.

The top 5 cost main extensions for both utilities are summarized below. The notes from the table above apply to this table as well.

Table 14: 2008 Top 5 Cost Main Extensions

Utility	Cost ($ 000)			Attachments			Consumption (GJ)			Consumption (GJ/Attachment)			PI
	Years 1-5 Forecast	Years 1-3 Forecast	YTD Actual	Years 1-5 Forecast	Years 1-3 Forecast	YTD Actual	Years 1-5 Forecast	Years 1-3 Forecast	YTD Actual	Years 1-5 Forecast	Years 1-3 Forecast	YTD Actual	Years 1-5 Forecast
FEI													
Trans-Canada Highway	$1,321,079	$1,224,075	$841,250	511	280	6	79,801	41,906	407	156	150	68	0.9
Juniper Road	$63,521	$51,297	$119,211	44	20	0	5,500	2,500	0	125	125	0	1.7
Crystal Creek Drive	$64,646	$66,648	$126,848	22	22	9	3,070	3,070	1,026	140	140	114	1.0
163 & 61A Avenue	$242,492	$242,560	$277,473	171	110	128	16,507	10,619	12,555	97	97	98	1.4
Rio Drive	$187,818	$188,654	$133,128	92	85	16	3,649	3,371	147	40	40	9	0.8
FEVI													
Players Drive	$265,791	$264,624	$284,519	74	74	49	13,307	13,307	1,856	180	180	38	1.5
French Road	$107,795	$106,793	$204,775	50	50	34	3,500	3,500	1,086	70	70	32	1.2
Hutchinson Road	$136,457	$135,032	$155,400	75	75	52	4,125	4,125	991	55	55	19	1.4
Sewell Road	$60,723	$60,587	$120,754	25	25	28	2,750	2,750	1,237	110	110	44	1.0
Phillips Road	$287,608	$332,976	$77,894	87	87	1	4,670	4,670	21	54	54	21	0.9

As discussed in the 2009 Main Extension Results section, although the 2008 attachment and consumption results have improved relative to the results presented to the Commission in 2009, the Companies will be following up with developers on specific projects to explore ways to improve attachment and consumption results where warranted.

On November 26, 2008, FEVI filed the Sooke Main Extension 2008 Annual Report. In the cover letter, FEVI indicated that it was filing the fifth and final annual report. Consequently, the Companies will not be reporting on the Sooke main extension in this Report.

In summary, for 2008 main extensions the MX Test promoted the fair and equitable treatment of customers and avoided undue discrimination. The full year's cohort of 2008 customers did not adversely affect the customers in existence at the beginning of the year.

GLOSSARY OF TERMS

The following definitions taken from the FEI General Terms & Conditions are relevant to the MX Test:

Contributions in Aid of Construction

If the economic test results indicate a Profitability Index of less than 0.8, the Main Extension may proceed provided that the shortfall in revenue is eliminated by contributions in aid of construction by the Customers to be served by the Main Extension, their agents or other parties, or if there are non-financial factors offsetting the revenue shortfall that are deemed to be acceptable by the British Columbia Utilities Commission.

FEI may finance the contributions in aid of construction for Customers. Contributions of less than $100 per Customer may be waived by FEI.

Contributions Paid by Connecting Customers

The total required contribution will be paid by the Customers connecting at the time the Main Extension is built. FEI will collect contributions from all Customers connecting during the first five Years after the Main Extension is built. As additional contributions are received from Customers connecting to the main extension, partial refunds will be made to those Customers who had previously made contributions. At the end of the fifth Year, all Customers will have paid an equal contribution, after reconciliation and refunds.

For larger Main Extension projects, FEI may use the Main Extension Contribution Agreement for initial contributions. Customers will be billed the contribution amount after the Main Extension is built.

Costs

The total costs to be used in the economic test include, without limitation

(a) the full labour, material, and other costs necessary to serve the new Customers including Mains, Service Lines, Meter Sets and any related facilities such as pressure reducing stations and pipelines;

(b) the appropriate allocation of FEI's overheads associated with the construction of the Main Extension;

(c) the incremental operating and maintenance expenses necessary to serve the Customers; and

(d) an allocation of system improvement costs.

In addition to the costs identified, the economic test will include applicable taxes and the appropriate return on investment as approved by the British Columbia Utilities Commission.

In cases where a larger Gas distribution Main is installed to satisfy future requirements, the difference in cost between the larger Main and the smaller Main necessary to serve the Customers supporting the application may be eliminated from the economic test.

Customer

A Person who is being provided Service or who has filed an application for Service with FEI that has been approved by FEI.

Economic Test

All applications to extend the Gas distribution system to one or more new Customers will be subject to an economic test approved by the British Columbia Utilities Commission. The economic test will be a discounted cash flow analysis of the projected revenue and costs associated with the Main Extension. The Main Extension will be deemed to be economic and will be constructed if the results of the economic test indicate a Profitability Index of 0.8 or greater for an individual main extension.

Gas

Means natural gas (including odorant added by FEI) and propane.

General Terms & Conditions of FortisBC Energy Inc

The general terms and conditions of FEI from time to time approved by the British Columbia Utilities Commission.

Geo Code Pricing

A unit cost methodology which is based upon the geographical region, typical ground conditions and length of service to be installed.

Gigajoule

A measure of energy equal to one billion joules used for billing purposes.

Main

Pipes used to carry Gas for general or collective use for the purposes of distribution.

Main Extension

An extension of one of FEI's mains with low, distribution, intermediate or transmission pressures, and includes tapping of transmission pipelines, the installation of any required pressure regulating facilities and upgrading of existing Mains, or

pressure regulating facilities on private property.

Meter Set

An assembly of FortisBC Energy owned metering and ancillary equipment and piping.

Person

Means a natural person, partnership, corporation, society, unincorporated entity or body public.

Premises

A building, a separate unit of a building, or machinery together with the surrounding land.

Profitability Index

The revenue to cost ratio comparing the revenues expected from a Main Extension project to the expected costs over a set period of time.

Revenue

The projected revenue to be used in the economic test will be determined by FortisBC Energy by

(a) estimating the number of Customers to be served by the Main Extension;

(b) establishing consumption estimates for each Customer;

(c) projecting when the Customer will be connected to the Main Extension; and

(d) applying the appropriate revenue margins for each Customer's consumption.

The revenue projection will take into consideration the estimated number and type of Gas appliances used and the effect variations in weather conditions throughout the applicable Service Area have on consumption. Customers who intend to install both high efficiency gas fired space (namely an Energy Star rated furnace or boiler) and water heating appliances (tankless water heaters, or water heaters with efficiency rating of 78 percent or greater), will receive a credit of 10 percent of the volume otherwise used for both appliances. Customers who intend to install both high efficiency gas fired space and water heating appliances and attain a minimum of LEEDTM (Leadership in Energy and Environmental Design) General Certification will receive a credit of 15 percent of the volume otherwise used for both. In addition, the projected revenue from Application Fees will be included. Only those Customers expected to connect to the Main Extension within 5 Years of its completion will be considered.

Service

The provision of Gas Service or other service by FEI.

Service Line

Means that portion of the gas distribution system extending from a Main or a Service Header to the Meter Set. In case of a Vertical Subdivision, or multi-family housing complex, the Service

Line may include the piping from the outlet of the Meter Set to the Customer's individual Premises.

Vertical Subdivision

A multi-storey building that has individually metered units and a common Service Header connecting banks of meters, typically located on each floor.

Year

A period of 12 consecutive months.

Attachment 101.3

REFER TO LIVE SPREADSHEET

Provided in electronic format only

(accessible by opening the Attachments Tab in Adobe)

Attachment 130.1

BRITISH COLUMBIA
UTILITIES COMMISSION

ORDER
NUMBER

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DRAFT ORDER

IN THE MATTER OF
the Utilities Commission Act, R.S.B.C. 1996, Chapter 473

and

Application by the FortisBC Energy Utilities
(comprising FortisBC Energy Inc., FortisBC Energy Inc. Fort Nelson Service Area,
FortisBC Energy (Whistler) Inc., and FortisBC Energy (Vancouver Island) Inc.)
for Approval of 2012 and 2013 Natural Gas Rates

BEFORE: D.A. Cote, Panel Chair/Commissioner
A.A. Rhodes, Commissioner
N.E. MacMurchy, Commissioner

O R D E R

WHEREAS:

A. On May 4, 2011, the FortisBC Energy Utilities (FEU or the Companies) filed an Application for their combined Revenue Requirements for FortisBC Energy Inc. (FEI), the Fort Nelson Service Area of FEI (Fort Nelson), FortisBC Energy (Whistler) Inc. (FEW), and FortisBC Energy (Vancouver Island) Inc. (FEVI), and for approval of interim and permanent natural gas delivery rates effective January 1, 2012 and permanent rates effective January 1, 2013, pursuant to sections 59 to 61 and 89 of the *Utilities Commission Act* (the Act), with any variance between 2012 interim rates and permanent rates to be refunded to or collected from customers by way of a rate rider following the approval of 2012 permanent rates;

B. FEI seeks, among other things, approval, pursuant to sections 59 to 61 of the Act, of a permanent natural gas delivery rate increase of **X.X** percent effective January 1, 2012 and a further X.X percent permanent increase effective January 1, 2013 representing an annual average lower mainland residential customer total bill increase of X.X percent in 2012 and a further X.X percent increase in 2013;

C. FEI further seeks approval of the Rate Stabilization Adjustment Mechanism (RSAM) rider for applicable rate classes and approval of the cost allocation to Thermal Energy Services (previously referred to as Alternative Energy Services) as set out in the Application;

D. Fort Nelson region seeks, among other things, approval pursuant to sections 59 to 61 of the Act, of a permanent natural gas delivery rate increase of X.X percent effective January 1, 2012 and a further X.X percent permanent increase effective January 1, 2013, representing an annual average Fort Nelson residential customer total bill increase of X.X percent in 2012 and a further X.X percent increase in 2013. Fort Nelson also seeks approval of the Rate Stabilization Adjustment Mechanism (RSAM) rider for applicable rate classes as set out in the Application;

E. FEW seeks, among other things, approval, pursuant to sections 59 to 61 of the Act, of a permanent natural gas delivery rate increase of X.X percent effective January 1, 2012 and a further X.X percent permanent increase effective January 1, 2013, representing an annual average residential customer total bill increase of X.X percent in 2012 and a further X.X percent increase in 2013, and approval of the Rate Stabilization Adjustment Mechanism (RSAM) rider for applicable rate classes as set out in the Application;

F. FEVI seeks, among other things, approval, pursuant to sections 59 to 61 of the Act and section 2.1 of the Special Direction, to maintain current natural gas rates for all customers other than those with specified rates in their transportation service agreements, for a two-year period commencing January 1, 2012. FEVI proposes to utilize the surplus that will exist in the Rate Stabilization Deferral Account (RSDA) to allow for rates to remain unchanged for 2013;

G. FEVI further seeks approval of its schedule of demand and commodity charges, forecast gross O&M expenditures and, pursuant to section 2.10 of the Special Direction, for its forecast cost of service, forecast capital expenditures, and forecast revenue as set out in the Application;

H. The FEU seek, among other things, approvals including: allocation of costs for shared services between the Companies; discontinuation, continuation, and creation of deferral accounts and the amortization and disposition of balances in deferral accounts; changes to depreciation rates; and pursuant to section 44.2 of the Act, for Energy Efficiency and Conservation (EEC) expenditures;

I. In addition to the specific requests included in the Application for each of the Companies, the FEU are collectively applying for a Commission determination of the combined utility cost of service for 2013, subject to the Companies obtaining, at a later date, the necessary approvals to amalgamate. In the event that amalgamation proceeds, the combined cost of service will provide the basis for a harmonized rate structure for an amalgamated entity;

J. On May 6, 2011, the Commission issued Order G-81-11 establishing Regulatory Timetable for the review of the Application as well as setting dates for a Workshop and a Procedural Conference. Further, Orders L-42-11 and L-45-11 Amended the Regulatory Timetable.

K. A Workshop took place on May 18, 2011 and a Procedural Conference took place on June 15, 2011.

L. The Commission has reviewed and considered the Application, the evidence and the submissions and has determined that the Application should be approved.

NOW THEREFORE the Commission orders as follows:

1. Pursuant to sections 59 to 61 of the *Utilities Commission Act* (the Act), the following approvals are granted for FEI:
   a. Approval of a permanent delivery rate increase to recover the revenue requirements as described in Section 3.3.1 of the Application, resulting in an increase of X.X percent, compared to 2011 delivery rates, for all non-bypass customers, effective January 1, 2012. The increase is to be applied to the delivery charge and the basic charge will remain at 2011 levels.
   b. Approval of the Rate Stabilization Adjustment Mechanism (RSAM) rider for customers served under FEI Rate Schedules 1, 1B, 1S, 1X, 2, 2U, 2X, 3, 3U, 3X and 23 effective January 1, 2012 of ($0.032)/GJ as set out in Section 3.4.3 of the Application (the 2013 RSAM rider will be adjusted with the FEI Fourth Quarter 2011 Gas Cost filing).
   c. Approval of the 2012 cost allocation to Thermal Energy Services (formerly Alternative Energy Services) as set out in Section 5.3.18 and Appendix G of the Application.
   d. Approval of the continuation of the debiting of the MCRA and crediting of the delivery margin revenue in the amount of $3.6 million per year for the 2012 forecast period as set out in Section 5.5 of the Application.
   e. Approval of the change in the allocation between the delivery margin and midstream of the SCP costs and revenues, and of the Spectra Energy Kingsvale South charges related to the NWN capacity as set out in Section 5.5 of the Application.
2. The following approvals are granted for FEVI:
   a. Pursuant to sections 59 to 61 of the Act and section 2.1 of the Vancouver Island Natural Gas Pipeline Agreement Special Direction (the "Special Direction"), approval of permanent rates for FEVI effective January 1, 2012 for Core Market sales and transportation customers, other than customers who have specified rates in their transportation service agreements, at the same level as 2011 rates.
   b. Pursuant to section 2.10(a)(i) of the Special Direction, approval of FEVI's forecast Cost of Service for 2012 as set out in Section 3.3.2 of the Application.
   c. Pursuant to section 2.10(a)(i) of the Special Direction, approval of FEVI's forecast capital expenditures for 2012, as set out in Section 6.2 of the Application.
   d. Pursuant to section 2.10(a)(ii) of the Special Direction, approval of FEVI's forecast revenue for 2012, based on its proposed rates, as set out in Section 4.5.6 of the Application.
   e. Pursuant to sections 59 to 61 of the Act, approval of the forecast gross O&M expenditures for 2012 of $35.236 million.
   f. Pursuant to sections 59 to 61 of the Act, approval of the 2012 cost of gas and discontinuation of the quarterly reporting of gas costs for FEVI as set out in Sections 5.2 and 6.3 of the Application.

g. Pursuant to sections 59 to 61 of the Act, approval of the difference between the net revenues received and the actual cost of service, excluding O&M variances from forecast, to be allocated to the RSDA, as set out in Section 3.4.2 of the Application.

3. Pursuant to sections 59 to 61 of the Act, the following approvals are granted for FEW:

   a. Approval of permanent delivery rates for FEW for all customers effective January 1, 2012, to recover the requested revenue requirements as described in section 3.3.3 of the Application, resulting in an increase of X.X per cent compared to 2011 delivery rates, with the increase to be applied to the delivery charge, holding the basic charge at 2011 levels.

   b. Approval of the RSAM rider for customers served under FEW Rate Schedules SGS 1/2, LGS 1, LGS 2 and LGS 3 effective January 1, 2012 of $0.524/GJ as set out in Section 3.4.3 of the Application. (2013 RSAM rider will be adjusted with the FEW Fourth Quarter 2011 Gas Cost filing.)

4. Pursuant to sections 59 to 61 of the Act, the following approvals are granted for Fort Nelson:

   a. Approval of permanent delivery rates for Fort Nelson customers effective January 1, 2012, to recover the requested revenue requirements as described in section 3.3.4 of the Application, resulting in an increase of X.X per cent compared to 2011 delivery rates, with the increase to be applied to the delivery charge and the minimum monthly service charge.

   b. Approval of the RSAM rider for customers served under Fort Nelson Rate Schedules 1, 2.1, 2.2 and 25 effective January 1, 2012 of ($0.011)/GJ as set out in Section 3.4.3 of the Application. (2013 RSAM rider will be adjusted with the Fort Nelson Fourth Quarter 2011 Gas Cost filing.)

5. Subject to the approval of the amalgamation of the FEU and harmonized rates for 2013, the Commission approves the following 2013 rates for the individual utilities:

   a. Pursuant to sections 59-61 of the Act, the following approvals are granted for FEI:

      i. Approval of permanent delivery rates for FEI for all non-bypass customers effective January 1, 2013, to recover the requested revenue requirements as described in section 3.3.1 of the Application, resulting in an increase of X.X per cent compared to 2012 delivery rates, with the increase to be applied to the delivery charge, holding the basic charge at 2011 levels.

      ii. Approval of the 2013 cost allocation to the Thermal Energy Services (previously referred to as Alternative Energy Services) customer class as set out in section 5.3.18 and Appendix G of the Application.

      iii. Approval to continue debiting of the MCRA and crediting of the delivery margin revenue in the amount of $3.6 million per year for the 2013 forecast period as set out in section 5.5 of the Application.

   b. The following approvals are granted for FEVI:

      i. Pursuant to sections 59-61 of the Act and section 2.1 of the Special Direction, approval of permanent rates for FEVI effective January 1, 2013 for Core Market sales and transportation customers, other than customers who have specified rates in their transportation service agreements, at the same level as 2011 rates.

ii. Approval pursuant to section 2.10(a)(i) of the Special Direction of FEVI's forecast Cost of Service for 2013 as set out in section 3.3.2 of the Application.

iii. Approval pursuant to section 2.10(a)(i) of the Special Direction of FEVI's forecast capital expenditures for 2013, as set out in section 6.2 of the Application.

iv. Approval pursuant to section 2.10(a)(ii) of the Special Direction of FEVI's forecast revenue for 2013, based on its proposed rates, as set out in section 4.5.6 of the Application.

v. Approval of the forecast gross O&M expenditures for 2013 of $35.482 million.

vi. Approval of the 2013 cost of gas as set out in section 5.2 of the Application.

vii. Approval for the difference between the net revenues received and the actual cost of service, excluding O&M variances from forecast, to be allocated to the RSDA, as set out in section 3.4.2 of the Application.

c. Pursuant to sections 59-61 of the Act, approval of permanent delivery rates for FEW for all customers effective January 1, 2013, to recover the requested revenue requirements as described in Section 3.3.3 of the Application, resulting in an increase of X.X per cent compared to 2012 delivery rates, with the increase to be applied to the delivery charge, holding the basic charge at 2011 levels.

d. Pursuant to sections 59 to 61 of the Act, approval of permanent delivery rates for Fort Nelson customers effective January 1, 2013, to recover the requested revenue requirements as described in Section 3.3.4 of the Application, resulting in an increase of X.X per cent compared to 2012 delivery rates, with the increase to be applied to the delivery charge and the minimum monthly service charge.

6. Pursuant to sections 59-61 of the Act, the following approvals are granted for FEI, FEVI, FEW and Fort Nelson to be used in the determination of rates for FEI, FEVI, FEW and Fort Nelson effective January 1, 2012:

a. Approval of the allocation of costs for corporate services between FortisBC Holdings Inc. and each of FEI, FEVI and FEW, as reflected in the Corporate Services Agreements between FortisBC Energy Holdings Inc. and FEI, FEVI and FEW as described in section 5.3.18 of the Application.

b. Approval of the allocation of costs for shared services between FEI and FEVI, as described in section 5.3.18 of the Application.

c. Approval of the allocation of costs for shared services between FEI and FEW, as described in section 5.3.18 of the Application.

d. Approval to allow for charges between regulated entities to be based on a fully loaded benefits and concessions charge and to not include overheads, including a facilities fee as described in section 5.3.18 of the Application.

e. Approval of the consolidated Core Market Administration Expense (for FEI, FEVI and FEW), and allocation percentages, as set out in section 5.2 of the Application.

f. Approval of the discontinuance, modification, and creation of deferral accounts, and the amortization and disposition of balances of deferral accounts, for FEI, FEVI, FEW and Fort Nelson all as set out in section 6.2 and Appendix G of the Application and summarized in the following table.

Type of Change	Account	Company	Reference
New Account	Compliance with Emissions Regulations	FEU	Section 6.3.2.3; Additions and Amortization period TBD
	Customer Service Variance Account	FEU	Section 6.3.3.10; Additions and Amortization period TBD
	2012-2013 Revenue Requirement Application Costs	FEU	Section 6.3.4.1; amortization period of 2 years commencing January 1, 2012, allocated to FEU based on average customers
	Long Term Resource Plan Application Costs	FEU	Section 6.3.4.1; amortization period of 2 years commencing January 1, 2013, allocated to FEU based on average customers
	Gas Assets Records Project	FEU	Section 6.3.5.11; amortization period of 5 years commencing January 1, 2012, allocated to FEU based on average customers
	BCOneCall Project	FEU	Section 6.3.5.12; amortization period of 5 years commencing January 1, 2012, allocated to FEU based on average customers
	Residual Delivery Rate Riders	FEI	Section 6.3.6.3; amortization period of 1 year commencing January 1, 2012
Amortization Period Change- New or Modified	Revenue Stabilization Account Mechanism	FEW	Section 6.3.1.3; recovery through Rate Rider 5, 3 year recovery period consistent with FEI and FN, commencing January 1, 2012
	Gas in Storage Interest	FEI	Section 6.3.1.4; 3 year amortization period, commencing January 1, 2012
	Property Tax Variance Account	FEW, FN	Section 6.3.3.1; change from 1 year to 3 year amortization period, commencing January 1, 2012
	Interest Variance Account	FEW, FN	Section 6.3.3.5; change from 1 year to 3 year amortization period, commencing January 1, 2012
	Tax Variance Account	FEW	Section 6.3.3.6; 1 year amortization period, commencing January 1, 2012
	Vancouver Island HST Implementation	FEVI	Section 6.3.3.7; 1 year amortization period, commencing January 1, 2012
	Victoria Regional Centre CPCN	FEVI	Section 6.3.4.3; 1 year amortization period, commencing January 1, 2012
	Pipeline Contributions Variance Account	FEW	Section 6.3.5.3; 1 year amortization period, commencing January 1, 2012

Type of Change	Account	Company	Reference
	Deferred Removal Costs	FEU	Section 6.3.5.5; 2 year amortization period, commencing January 1, 2012
	IFRS Transitional Account	FEI, FEVI	Section 6.3.5.7; amortization by plan over EARSL
	2010-2011 Customer Service O&M and Cost of Service	FEU	Section 6.3.5.9; 8 year amortization period, commencing January 1, 2012
Other	Energy Efficiency and Conservation	FEU	Section 6.3.2.1; 1. Combined EEC rate base deferral account additions of $20.0 million in 2012 and $20.0 million in 2013, included on a net-of-tax basis and amortized in rates over a ten year period; 2. The allocation of the 2012 and 2013 EEC rate base deferral account additions amongst Mainland, Vancouver Island and FEW on an average customer basis; 3. The creation of the EEC rate base deferral account for FEW, with additions included on a net-of-tax basis and amortized in rates over a ten year period; 4. The creation of the EEC Incentive non-rate base deferral account for FEI attracting AFUDC, to capture the remaining portion of the EEC costs as incurred and allocated by FEI to each utility based on the actual spend in the service area of each utility in 2012 and 2013, and to recover the balance over a ten year period beginning in 2014.
	CNG and LNG Service Costs and Recoveries	FEI	Section 6.3.2.6; inclusion of variations from the revenue forecast pertaining to Rate Schedule 16
	Property Tax Variance Account	FEW	Section 6.3.3.1; include the forecast balance of the existing Propane Plant Property Tax Deferral account in the Property Tax Variance account
	Tax Variance Account	FEI	Section 6.3.3.6; inclusion of LILO reassessment costs
	Gains and Losses on Asset Disposition	FEU	Section 6.3.5.6; transfer the general plant gains and losses as at January 1, 2010 from the IFRS Transitional account into the Gains and Losses on Asset Disposition account; 20 year amortization period, commencing January 1, 2012
Discontinuance	Residential Commodity Unbundling Account	FEI	Appendix G, 2.2; discontinuation of this account effective January 1, 2012

Type of Change	Account	Company	Reference
	Commercial Commodity Unbundling Account	FEI	Appendix G, 2.2; discontinuation of this account effective January 1, 2012

g. Approval of changes to the following accounting policies to be used in the determination of rates for FEI, FEVI, FEW and Fort Nelson effective January 1, 2012:

   i. The depreciation and amortization rates and the creation of a separate sub account (474.02) to record future additions to Distribution Systems Meters/Regulator Installations with depreciation expense for this sub account calculated using a whole life rate, set out in Sections 5.4.2 and 5.4.5 of the Application.

   ii. The negative salvage rates and the treatment of negative salvage as set out in Section 5.4.3 of the Application.

   iii. Modification to the approved Lead Lag days with the removal of the GST and PST lead days and the insertion of the proposed HST and REC lead days as set out in Section 6.1 of the Application.

7. With respect to Energy Efficiency and Conservation ("EEC") expenditures, the Commission orders as follows:

   a. Pursuant to section 44.2(a) of the Act, the Commission accepts the following EEC expenditure schedules for the FEU to be spent on the EEC program areas described in Appendix K-1 of the Application, including the expansion of the interruptible industrial Program Area eligibility to customers of FEVI and all EEC program eligibility to customers of FEW and Fort Nelson:

      i. $17.8 million for FEI for each of 2012 and 2013;

      ii. $2.0 million for FEVI for each of 2012 and 2013;

      iii. $0.2 million for FEW for each of 2012 and 2013;

      iv. An additional $54.5 million for FEI for each of 2012 and 2013 to be spent in the service areas of FEI, FEVI, FEW and Fort Nelson.

   b. Pursuant to sections 59 to 61 of the Act, the Commission approves the treatment of EEC costs in accordance with the EEC deferral accounts as described in the table of deferral accounts above in section 6.

   c. With respect to assessing EEC expenditures, the Commission directs FEU pursuant to section 43 of the Act as follows:

      i. To continue to file an EEC Annual Report in which it will:

         1. Continue to evaluate EEC expenditures as an overall portfolio, and with Innovative Technologies having an additional criterion that as an individual program area it must have a benefit-cost ratio of 1.0 or greater, as previously approved in the 2010-2011 RRA;

2. To continue to report on funding transfers between approved program areas.
3. Continue to evaluate EEC expenditures on the basis previously approved by the Commission, except with respect to the following changes.
    a. The overall portfolio including all EEC-funded activity, and the Innovative Technology program area individually, should have a benefit-cost result of 1.0 or greater, using a Societal Cost Test consisting of the following three modifications to the current benefit-cost analysis:
        i. Use of a social discount rate of 3 percent, rather than the Companies' weighted average cost of capital;
        ii. Use of the ceiling price for biomethane, which is based on an efficiency-adjusted cost of electricity, as the avoided cost of gas, for all EEC programs except for the NGV incentive program which will continue to use the forward projection of market costs for conventional fossil fuel-based natural gas;
        iii. Use of a "deemed adder" of 30 percent for non-energy benefits of EEC activity.
    b. The inclusion of spillover in the calculation of the Net-to-Gross Ratio when estimating program effects.

8. In anticipation of an Amalgamation and Rate Design Phase 'A' Application to be filed in Fall 2011 for 2013 harmonized rates, the following approvals are granted as an initial stage in the ratemaking process for an amalgamated utility including FEI, FEVI, FEW and Fort Nelson. For clarity, these approvals do not pre-determine the merits of any future application by the FEU to address amalgamation and harmonized rates, or the allocation of costs among rate classes or as between delivery rates and the midstream. The approvals are as follows:
    a. Pursuant to sections 59-61 of the Act, approval of an amalgamated cost of service for 2013 for FEI, FEVI, FEW and Fort Nelson combined as set out in section 3.3.5 of the Application.
    b. Pursuant to sections 59-61 of the Act, approval of a deferral account to capture the costs and savings related to the amalgamation that vary from the forecast of zero for 2013.
    c. Pursuant to section 99 of the Act, approval to defer the filing of evidence with respect to FEVI and FEW's equity component required by Directive No. 7 of Commission Order G-158-09, to the Amalgamation and Rate Design Phase 'A' Application in Fall 2011 as described in section 5.7 of the Application.

DATED at the City of Vancouver, In the Province of British Columbia, this day of <MONTH>, 20XX.

BY ORDER

Attachment 131.1

REFER TO LIVE SPREADSHEETS

Provided in electronic format only

(accessible by opening the Attachments Tab in Adobe)

Attachment 133.1

REFER TO LIVE SPREADSHEETS

Provided in electronic format only

(accessible by opening the Attachments Tab in Adobe)

Attachment 135.1

REFER TO LIVE SPREADSHEET
Provided in electronic format only

(accessible by opening the Attachments Tab in Adobe)

Attachment 139.2

LARRY E. KENNEDY

TECHNICAL SPECIALTIES

Public Utility Plant Depreciation
Public Utility Plant Accounting

PERSONAL INFORMATION

Diploma, Applied Arts - Business Administration, Northern Alberta Institute of Technology, 1978
Member, Society of Depreciation Professionals
Certified Depreciation Professional

EXPERIENCE

Mr. Kennedy joined Gannett Fleming, Inc. in January 1999 and is the Director of Canadian Services for the Valuation and Rate Division. His responsibilities include the assembly of data, the preparation and review of depreciation studies, advice to clients regarding asset retirement obligation accounting, plant accounting issues, and provision of general regulatory litigation support.

Representative assignments include:

- International Financial Reporting Standards (IFRS). Mr. Kennedy has been retained by numerous clients encompassing most Canadian Provinces and Territories. The assignments included the review of company's assets and depreciation practices to provide opinion on the compliance to the IFRS. The assignments have also included the issuance of opinion to the External Auditors of Utilities to comment on the manner in which the Utilities can minimize differences in the regulatory ledgers and the accounting records used for financial disclosure purposes. Mr. Kennedy has also presented to the Canadian Electric Association, the Society of Depreciation Professionals and to the British Columbia Utilities Commission on this topic.

- Fortis Inc. Studies have included the development of annual and accrued depreciation rates for the electric distribution assets in Alberta and for the generation, transmission, and distribution assets in British Columbia. The FortisBC study was completed and filed with the BCUC in 2005. FortisAlberta studies were completed in 2004 (updated in 2005) and in 2009. Elements of the studies included the development of average service lives using the retirement rate method of analysis, development of net salvage estimates, and the determination of appropriate annual accrual and accrued depreciation rates.

- BC Hydro. This assignment included the development of an average service life study for all of the BC Hydro's electric generation, transmission, distribution and general plant assets. The study, which was prepared for submission to the British Columbia Utilities Commission ("BCUC), included development of depreciation policy for the company, development of procedures to extract data from the company databases, tours of the company facilities, interviews with operational and management representatives, and the compilation of a detailed report. The assignment has included the support of the study through the regulatory process.

- AltaLink LP. A study was developed for submission to the Alberta Energy and Utilities Board in 2002. The study included the estimation of service life characteristics, and the estimation of net salvage requirements for all electric transmission assets. A net salvage study and technical update was also filed with the Board in 2004, and a second average service life study was filed in 2005.

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- Newfoundland and Labrador Hydro. Mr. Kennedy developed a comprehensive depreciation study that included the development of depreciation policy and rates for Newfoundland and Labrador Hydro. The study provided a significant review of the previous depreciation policy, which included use of a sinking fund depreciation method and provided justification for the conversation to the straight-line depreciation method. The study, which was prepared for submission to the Newfoundland and Labrador Utilities Commission, included a significant amount of discussion regarding the development of depreciation policy for the company. The study also included development of procedures to extract data from the company databases, tours of the company facilities, interviews with operational and management representatives, development of appropriate net salvage rates, development of average service life estimates, and the compilation of the report for submission in a General Tariff Application.

- ATCO Electric. Studies have included the development of annual and accrued depreciation rates for the electric transmission and distribution systems for the Alberta Assets of ATCO Electric, in addition to the generation, transmission, and distribution assets of Northland Utilities (NWT) Inc. and the distribution assets of Northland Utilities (Yellowknife) Inc. The ATCO Electric study was submitted to the Alberta Energy and Utilities Board for review, while the Northland Utilities Inc. studies were submitted to the Northwest Territories Utilities Board. Elements of the studies included the service life analysis for all accounts using the retirement rate analysis, discussion with management regarding outlook, and the estimation of net salvage requirements.

- Yukon Energy Corporation. The study included the development of annual accrual and accrued depreciation rates for all electric generation, distribution and transmission assets. The study was completed in 2004 and submitted to the Yukon Energy and Utilities Board in 2005. The study included the development of appropriate depreciation policies, site tours of company facilities, and operational and management interviews. Development of average service lives; net salvage estimates and depreciation rates were based on statistical analysis of company data, operational and management meetings, and site tours.

- ENMAX Power Corporation. Studies have included the development of annual and accrued depreciation rates for all depreciable electric transmission assets. Elements of the studies included the service life analysis for all accounts using the retirement rate analysis, discussion with management regarding outlook, and the estimation of net salvage requirements. Studies were prepared for submission to the Alberta Department of Energy and more recently for submission to the Alberta Energy and Utilities Board. Similar studies have also been completed for submission for the ENMAX Electric Distribution assets for submission to the Alberta Energy and Utilities Board. The ENMAX distribution asset assignments also included an extensive asset verification project where the plant accounting and operational asset records were verified to the field assets actually in service.

- Manitoba Hydro. A study was developed to determine the appropriate depreciation parameters for all electric generation, transmission and distribution assets. The study was submitted to the Manitoba Public Utilities Board. Elements of the study included a field review of electric generation and transmission plant, the service life analysis for all accounts using the retirement rate analysis, discussion with management regarding outlook, and the estimation of net salvage requirements. A similar study was also completed in 2006.

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- Centra Gas Manitoba, Inc. The study included development of annual and accrued depreciation rates for all gas plant in service. Elements of the study included a field inspection of metering and compression facilities, service buildings and other gas plant; service life analysis for all accounts using the retirement rate analysis on a combined database developed from actuarial data and data developed through the computed method; discussions with management regarding outlook; and the estimation of net salvage requirements. A similar study was completed in 2006.

- TransCanada PipeLines Limited – Alberta Facilities. The assignment included working with the company to develop the appropriate depreciation policy to align with the organization's overall goals and objectives. The resulting depreciation study, which was submitted to the Alberta Energy and Utilities Board, incorporated the concepts of time-based depreciation for gas transmission accounts and unit based depreciation for gathering facilities. The data was assembled from two different accounting systems and statistical analysis of service life and net salvage were preformed. For gathering accounts, the assignment included the oversight of the development of appropriate gas production and ultimate gas potential studies for specific areas of gas supply. Field inspections of gas compression, metering and regulating, and service operations were conducted. Studies were completed in 2002 and 2004, 2007 and 2009.

- TransCanada PipeLines Limited – Mainline Facilities. The study prepared for submission to the National Energy Board of Canada included the development of annual and accrued depreciation rates for gas transmission plant east of the Alberta – Saskatchewan border. Elements of the study included a field inspection of compression and metering facilities, service life and net salvage analysis for all accounts. The study was completed in 2002, and was supported through an appearance before the NEB. Study updates have been completed in 2005, 2007 and 2009.

- AltaGas Utilities Inc. A number of depreciation studies have been completed, which included the assembly of basic data from the Company's accounting systems, statistical analysis of retirements for service life and net salvage indications, discussions with management regarding the outlook for property, and the calculations of annual and accrued depreciation. The studies were prepared for submission to the Alberta Energy and Utilities Board.

- Mackenzie Valley Pipeline Project. This assignment included the review of the proposed depreciation schedule for the proposed Mackenzie Valley Pipeline. The review included a discussion of the policies used by the company and the depreciation concepts to be included in a depreciation schedule for a Greenfield pipeline. The review was supported through appearance at the oral public hearings before the National Energy Board of Canada.

- Alberta Municipal Affairs. The first assignment was conducted in two phases. The first phase involved significant consultation with the Alberta Department of Municipal Affairs and various stakeholder groups to develop a report outlining the method of depreciation that would most appropriately result in a fair market value assignment for the Province's oil and gas pipelines, and for all segments of the electric industry (generation, transmission and distribution). The second phase of the project was to develop specific depreciation schedules to implement the recommendations that were accepted by Alberta Municipal Affairs for the oil and gas pipelines, as well as for all three aspects of the Province's electric industry. A second assignment related to developing models for the determination of the fair assessment value for the Province's Telecommunication and Railway Systems was completed in 2004, and was updated in 2005 and 2006.

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- Property Tax Appeals. Mr. Kennedy has provided expert evidence regarding the fair market valuation for a number of clients before the Alberta Municipal government Board.

- The City of Calgary. These assignments consisted of providing advice and testimony for the City of Calgary on depreciation issues in various general rate applications. Elements of these assignments include the review of applicant evidence and policies, development of information requests, submission of evidence, response to information requests, and providing expert testimony.

Mr. Kennedy has successfully completed the series of week-long programs offered by Depreciation Programs, Inc. and is a past president of the Society of Depreciation Professionals.

Mr. Kennedy has appeared as an expert witness before various regulatory boards as summarized in the attached “Summary of Appearances”.

LARRY E. KENNEDY

SUMMARY OF APPEARANCES BEFORE REGULATORY BOARDS

Year	Client	Applicant	Regulatory Board	Proceeding Number
1999	ENMAX Corporation	Edmonton Power Corporation	Alberta Energy and Utilities Board	980550
2001	City of Calgary	ATCO Pipelines South	Alberta Energy and Utilities Board	2000-365
2001	City of Calgary	ATCO Gas South	Alberta Energy and Utilities Board	2000-350
2001	City of Calgary	ATCO Affiliate Proceeding	Alberta Energy and Utilities Board	1237673
2003	AltaLink Management Ltd	AltaLink Management Ltd	Alberta Energy and Utilities Board	1279345
2003	TransCanada PipeLines Limited	TransCanada PipeLines Limited	National Energy Board of Canada	RH-1-2002
2003	City of Calgary	ATCO Gas	Alberta Energy and Utilities Board	1275466
2003	City of Calgary	ATCO Electric	Alberta Energy and Utilities Board	1275494
2004	NOVA Gas Transmission Limited	NOVA Gas Transmission Limited	Alberta Energy and Utilities Board	1315423
2004	ENMAX Power Corporation	ENMAX Power Corporation	Alberta Energy and Utilities Board	1306819
2004	Westridge Utilities Inc	Westridge Utilities Inc.	Alberta Energy and Utilities Board	1279926
2004	Heritage Gas Ltd.	Heritage Gas Ltd.	Nova Scotia Utility and Review Board	N/A
2004	Central Alberta Midstream	Central Alberta Midstream	Municipal Government Board of Alberta	N/A
2004	AltaLink LP	AltaLink LP	Alberta Energy and Utilities Board	1336421
2004	Central Alberta Midstream	Central Alberta Midstream	Municipal Government Board of Alberta	N/A
2005	AltaGas Utilities Inc.	AltaGas Utilities Inc.	Alberta Energy and Utilities Board	1378000
2005	ATCO Power	ATCO Power	Municipal Government Board of Alberta	N/A
2005	ENMAX Power Corporation	ENMAX Power Corporation- Distribution Assets	Alberta Energy and Utilities Board	1380613
2005	Newfoundland and Labrador Hydro	Newfoundland and Labrador Hydro	Newfoundland and Labrador Board of Commissioners of Public Utilities	Study submitted
2006	AltaLink LP	AltaLink LP	Alberta Energy and Utilities Board	1456797
2006	Imperial Oil Resources Ventures Limited	McKenzie Valley Pipeline Project	National Energy Board of Canada	GH-1-2004
2008	ATCO Electric	Yukon Electrical Company Limited	Yukon Utilities Board	N/A
2009	Fortis Alberta Inc.	Fortis Alberta, Inc.	Alberta Utilities Commission	1605170

LARRY E. KENNEDY

SUMMARY OF APPEARANCES BEFORE REGULATORY BOARDS

Year	Client	Applicant	Regulatory Board	Proceeding Number
2010	Gazifere	Gazifere	La Regie de L'Energie	R-3724-2010
2010	ATCO Electric	ATCO Electric	Alberta Utilities Commission	1606228
2011	ATCO Gas	ATCO Gas	Alberta Utilities Commission	1606822-Appearance Pending
2011	AltaLink	AltaLink	Alberta Utilities Commission	1606895-Appearance Pending
2011	Qulliq	Qulliq	Utilities Rates Review Council	Appearance Pending
2011	AltaGas Utilities Inc.	AltaGas Utilities Inc.	Alberta Utilities Commission	Appearance Pending
2011	Fortis Alberta Inc.	Fortis Alberta, Inc.	Alberta Utilities Commission	Appearance Pending

LARRY E. KENNEDY

SUMMARY OF CASES WHERE EVIDENCE WAS PROVIDED BUT APPEARANCES WERE NOT REQUIRED

Year	Client	Applicant	Regulatory Board	Proceeding Number
2000	AltaGas Utilities Inc.	AltaGas Utilities Inc	Alberta Energy and Utilities Board	Decision 2002-43
2001	ENMAX Power Corporation	ENMAX Power Corporation – Electric Transmission Assets	Alberta Department of Energy	N/A
2002	Centra Gas British Columbia	Centra Gas British Columbia	British Columbia Utilities Commission	N/A
2002	ENMAX Power Corporation	ENMAX Power Corporation – Electric Transmission Assets	Alberta Department of Energy	N/A
2003	Centra Gas Manitoba	Centra Gas Manitoba	Manitoba Public Utilities Board	N/A
2003	Manitoba Hydro	Manitoba Hydro	Manitoba Public Utilities Board	N/A
2003	City of Calgary	ATCO Pipelines	Alberta Energy and Utilities Board	1292783
2003	City of Calgary	ATCO Electric –ISO Issues	Alberta Energy and Utilities Board	N/A
2004	AltaGas Utilities Inc.	AltaGas Utilities Inc.	Alberta Energy and Utilities Board	1305995
2005	Yukon Energy Corporation	Yukon Energy Corporation	Yukon Utilities Board	N/A
2005	NOVA Gas Transmission Ltd.	NOVA Gas Transmission Ltd.	Alberta Energy and Utilities Board	1375375
2005	FortisAlberta Inc.	FortisAlberta Inc.	Alberta Energy and Utilities Board	1371998
2005	ATCO Electric	ATCO Electric	Alberta Energy and Utilities Board	1399997
2005	The City of Red Deer	The City of Red Deer Electric System	Alberta Energy and Utilities Board	1402729
2005	Northland Utilities (Yellowknife) Inc.	Northland Utilities (Yellowknife) Inc.	Northwest Territories Utilities Board	N/A
2005	Northland Utilities (NWT) Inc.	Northland Utilities (NWT) Inc	Northwest Territories Utilities Board	N/A
2005	ENMAX Power Corporation	ENMAX Power Corporation- Transmission Assets	Alberta Energy and Utilities Board	N/A
2005	FortisBC, Inc	FortisBC, Inc	British Columbia Utilities Commission	N/A
2005	New Brunswick Board of Commissioners of Public Utilities	New Brunswick Power Distribution and Customer Service Company	New Brunswick Board of Commissioners of Public Utilities	N/A
2005	British Columbia Transmission Corporation	British Columbia Transmission Corporation	British Columbia Utilities Commission	N/A
2006	BC Hydro	BC Hydro	British Columbia Utilities Commission	N/A
2005	FortisAlberta Inc.	FortisAlberta Inc.	Alberta Energy and Utilities Board	N/A
2007	Enbridge Pipelines Limited	Enbridge Pipelines Limited	National Energy Board of Canada	RH-2-2007
2007	Fortis Alberta Inc.	Fortis Alberta Inc.	Alberta Energy and Utilities Board	1514140
2007	Kinder Morgan	Terasen (Jet fuel) Pipeline Limited	British Columbia Utilities Commission	N/A
2008	ATCOGas	ATCOGas	Alberta Utilities Commission	1553052

LARRY E. KENNEDY

SUMMARY OF CASES WHERE EVIDENCE WAS PROVIDED BUT APPEARANCES WERE NOT REQUIRED

Year	Client	Applicant	Regulatory Board	Proceeding Number
2008	Heritage Gas	Heritage Gas Ltd.	Nova Scotia Utility and Review Board	N/A
2008	ENMAX Power Corporation	ENMAX Power Corporation	Alberta Utilities Commission	1512089
2008	City of Lethbridge Electric System	City of Lethbridge	Alberta Utilities Commission	
2009	AltaGas Utilities Inc.	AltaGas Utilities Inc.	Alberta Utilities Commission	N/A
2010	Enbridge Pipelines Limited - Line 9	Enbridge Pipelines Limited - Line 9	National Energy Board of Canada	N/A
2010	Kinder Morgan	Kinder Morgan	National Energy Board of Canada	N/A

JOHN J. SPANOS

TECHNICAL SPECIALTIES

- Public Utility Plant Depreciation
- Public Utility Plant Original Cost

PERSONAL INFORMATION

M.B.A., York College of Pennsylvania, 1997
B.S., Industrial Management and Mathematics, Carnegie-Mellon University, 1986
Member, Society of Depreciation Professionals
Member, American Gas Association Industry Accounting Committee
Certified Depreciation Professional

EXPERIENCE

Mr. Spanos joined the firm in 1986 and is a Vice President of the Valuation and Rate Division. He assembles and oversees the basic data required for depreciation studies, conducts statistical analyses of accounting data, estimates service life and net salvage, and calculates annual and accrued depreciation. He performs field inspections for purposes of estimating service lives and verifying property records for original cost, bond indenture and depreciation studies. He also has supervised the updating of continuing property records.

Several assignments include:

- The Cincinnati Gas & Electric Company and Subsidiaries - Depreciation Studies for Gas and Electric. The studies included development of annual depreciation rates for all gas and electric plant in service for The Cincinnati Gas & Electric Company; Union Light, Heat and Power Company; and The Lawrenceburg Gas Company. Field inspections of electric and gas facilities were performed. Statistical analyses of service life and salvage data were conducted. Annual and accrued depreciation were calculated using several alternative bases and procedures.

- Chugach Electric Association - Depreciation Study. The elements of the study included a field inspection of power plants and major substations, data assembly and life analysis for generation and transmission accounts, discussions with management regarding outlook, the estimation of service life and net salvage and the calculation by plant account of annual depreciation rates.

- Northwest Territories Power Corporation. The depreciation study included assembly of basic data from the Corporation's property record listing, statistical analyses of retirements for indications of service life, an extensive field review of facilities, discussions with management regarding the outlook for the property, calculations of annual and accrued depreciation using several accepted procedures and bases and a report setting forth the study results.

- Omaha Public Power District. The study involved supervision of OPPD personnel assembling the basic plant accounting data required for analysis of historical indications of service life and net salvage. The data were analyzed using both the retirement rate method and the simulated plant record method. The net salvage estimates for the power plants were based on a regression analysis of industry cost of retiring data that correlated the cost per kilowatt with each unit's kilowatt capacity. A field review and discussions with management provided an outlook for future service lives compared to historical indications. The calculations of annual and accrued depreciation using several combinations of procedures and bases were performed and presented to management.

JOHN J. SPANOS

- Penn Fuel Gas, Inc. This assignment involved 26 service districts which were organized into seven operating groups for this gas distribution company. Our responsibilities included establishing continuing property records for each district. Some districts had previous work performed and others needed a complete review of accounting records, field inspections and digitization of distribution maps. The original costs and property identification were entered into an in-house created computer data base to facilitate the preparation of a service life study and the establishment of a mechanized property record system.

- Pennsylvania-American Water Company. Several studies have been performed for the Company and include the estimation of service lives, unitization of acquired treatment plant facilities and the determination of original costs for acquired water systems. The service life study included data assembly of two predecessor water systems, statistical analyses of service life and calculation of annual depreciation accrual rates for a rate filing with the state commission. The unitization of treatment plant facilities included a field inspection of each acquired plant and identification of property on a retirement unit basis for establishing property records. The determination of the original cost of assets to be acquired from small water systems within Pennsylvania included field reviews of the water systems, verification of plant accounting records, Handy-Whitman indexing of property costs and establishment of original cost less depreciation.

- Duquesne Light Company. The assignment involved performing an independent engineer's certificate report of actual property in service. A random sample of all types of property was selected and verified through a physical inventory. The thorough physical inventory included production, transmission, distribution and general plant. The final results were documented and filed with the Company's mortgage bond trustee.

- United Telephone of New Jersey, Inc. This assignment included an extensive physical inventory of telephone plant for the five predecessor companies. A random sample of each type of property for each predecessor company was inventoried by serial number. The final results were documented and filed with the Company's mortgage bond trustee.

- Nova Gas Transmission Ltd. The study incorporated the use of time-based depreciation for transmission and general accounts and unit of production depreciation method for gathering accounts. The data were assembled by account and statistical analyses of service life and salvage were performed. For the gathering accounts, the property was identified by specific production areas for calculation of depreciation on a unit basis. Field inspections of gas transmission facilities were conducted. Discussions with key personnel regarding management policy compared to several depreciation alternatives were presented for determination of final depreciation rates.

Mr. Spanos' technical education has included formal instructional programs offered by Depreciation Programs, Inc. Courses successfully completed include "Techniques of Life Analysis", "Techniques of Salvage and Depreciation Analysis", "Forecasting Life and Salvage", "Modeling and Life Analysis Using Simulation", and "Managing a Depreciation Study". Mr. Spanos also completed the week long course "Introduction to Public Utility Accounting" conducted by the American Gas Association.

Attachment 153.2

Charges for Service Line Work

Replaces: CUS 07-05 dated 16 July 2009

Overview

This standard specifies the charges for the installation, alteration, or abandonment of service lines to customers in accordance with the FortisBC (Natural Gas), the FortisBC (Vancouver Island) Inc., and FortisBC (Whistler) Inc. (collectively referred to as FBC (Gas)) tariffs.

Audience

This document is intended for employees working in the Customer Contact Centre, Planning & Design, and Marketing departments who are involved in installation, alteration, repair, or abandonment of service lines to customers.

References

- CUS 07-08 *Main Extensions*
- DES 04-01-13 *Distribution Set and Delivery Pressure*
- DES 07-17 *Locating Meter Sets*
- **FortisBC (Natural Gas)**
- **FortisBC (Vancouver Island) Inc. Tariff**
- **FortisBC (Whistler) Inc. Tariff**
- **Safety Standards Act** *Gas Safety Regulation* Government of British Columbia
- **CSA B149.1** *Natural Gas and Propane Installation Code*
- **CSA B149.2** *Propane Storage and Handling Code*
- **CSA Z662** *Oil and Gas Pipeline Systems*
- FBC (Gas) Knowledge Base

Definitions

BCUC

British Columbia Utilities Commission.

Caution: Printed documents may not be current. Verify online.

Conversion Service

A new gas service installed at a pre-existing building.

CAFE

Customer Attraction Front End (CAFE) is a custom software tool developed for FBC (Gas) that provides a "front end" interface to SAP. It is primarily used to process data resulting from customer related work such as gas service applications, main extensions, abandonments and alterations. CAFE is also configured to perform the economic test.

General or Standard Terms and Conditions

The General or Standard Terms and Conditions are part of the FBC (Gas) Tariff and are approved by the BCUC.

Economic Test (MX Test)

The economic test is a discounted cash flow analysis of the projected revenues and costs associated with a main extension and has been approved by the BCUC. The total revenues and costs for the main extension project are analyzed over a 20-year period, based on the number of customers projected to connect to the main extension within five years of construction, along with their forecast annual consumption. The economic test determines whether or not a contribution is required from those customers connecting to the main extension within the first five years of construction.

- See **CUS 07-08** *Main Extensions.*

Economic Pricing

When a customer requests a service attachment to a new main (less than or equal to five years of age) **and** the estimated costs for that service line were included in the economic test for the main it is being attached to, the customer would only be required to pay the Application Fee and any additional charges such as meter protection, extra length past standard meter location, or winter charges. Economic Pricing is the term used to describe the method of estimating costs for these cases.

Geo Pricing

Geo pricing is the standard methodology for estimating the cost of installing a service line. It is a unit cost methodology which is based upon both the geographical region, typical ground conditions, and length of service to be installed.

FBC (Gas) service territories have been reviewed and assigned a "geo code", which essentially groups different areas together under the assumption that they exhibit common characteristics with regards to the general conditions under which service line installations take place.

On an annual basis, all service installations within each geo code are analyzed in order to estimate the unit cost (per metre) associated with service line installations in that area. The results of this analysis provide the basis for pricing new services for the following year (until the next analysis is completed), and are uploaded into CAFÉ when the analysis is completed.

Manual Pricing

Manual pricing, also known as free form or detailed estimating, is the process of estimating the installation costs for service line where atypical conditions exist. Atypical conditions would include (but are not limited to) the need for blasting or directional drilling, or in cases where larger pipe sizes are required, where environmental concerns exist, or in cases where either the length of service or expected cost of the installation is significantly greater than normal. Conditions under which manual pricing should be used are listed in the document called "Business Rules for Manual Estimating" found in the FBC (Gas) Knowledge Base.

SAP

SAP is a business application software tool that supports order fulfillment, and includes customer-related work such as gas service applications, main extensions, planning and work management tools. It also supports the financial, budgeting, controlling, materials management, inventory management, purchasing, measurement technologies, plant management, operate & maintain, and human resource functions.

Service Header

A service header is a gas distribution pipeline located on private property that is connecting three or more service lines or meter sets to a main.

Service Lateral

Also known as a branch service and is a service line connected to a prime service or a service header.

Caution: Printed documents may not be current. Verify online.

Service Line

The service line is the portion of FBC (Gas) gas distribution system extending from a main or a service header to the inlet of the meter set or inlet of multi meter manifold. In case of a vertical subdivision, or multi-family housing complex, the service line may include the piping from the outlet of the meter set to the customer's individual premises, but not within the customer's individual premises.

Service Line Cost Allowance

Service Line Cost Allowance (SLCA) represents the maximum allowable expenditure that FBC (Gas) will invest to install a service line to connect a new customer to the gas distribution system.

Service Line Connection Fee

The service line connection fee is the estimated cost of installing the service which exceeds the SLCA that will be charged to the customer.

Standard Fees and Charges

Table 1: Standard Fees and Charges

Application Fee	
Account transfer fee	$25
New Installation	$25
New Installation - Manifold Meters	$25 per meter
New Installation - Vertical Subdivision	$25 per meter
Service Line Cost Allowance	
Duplex	$3070
Other than a duplex	$1535

Application for New Service

Connection Fee

The connection fee includes the Application Fee and the service line connection fee and other charges if applicable. In addition, FBC (Gas) may charge the customer for all additional costs, incurred as a result of installing a service line by way of a customer request rather than FBC (Gas) preferred installation, (see **Customer Requested Routing**).

For large commercial and industrial customers who have a forecast annual consumption of 2000 GJ/yr or greater, FortisBC will perform an economic test to determine the amount of the service line connection fee. See **CUS 07-08** Main Extensions.

The connection fee may be billed on the customer's first invoice unless:

- It is a mass market customer and the contribution exceeds $1,500.
- FBC (Gas) is not comfortable with the builder developer's is known to have a questionable credit rating and the contribution exceeds $1,500.

Application Fee

The Application Fee for a new service is$25 per gas meter.

Service Line Connection Fee

The service line connection fee is a contribution in aid of construction. For residential and small commercial customers the service line connection fee is subject to the type of pricing the customer is eligible for. These pricing types are standard, manual, full cost, or economic.

Customers may be charged if:

- Standard or manual pricing is required and the estimated installation costs exceed the SLCA (the connection fee in these cases will equal the difference between the estimated installation costs and the SLCA).
- Full cost is required and the customer is not eligible for the SLCA, (see Additional Gas Services)

Customers may not be charged if:

- Standard or manual pricing is required and the estimated installation costs are less than the SLCA.
- Economic pricing applies.

In cases where the economic test is applied to a new service attachment it will determine the service line cost.

- See **CUS 07-08** Main Extensions

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Service Line Cost Allowance (SLCA)

As discussed above in the definitions, the SLCA represents the maximum amount FBC (Gas) will invest to install a new residential or small commercial customer to the gas distribution system. The principal objective of the SLCA is to limit the costs the utility would otherwise incur for new customers with extraordinary connection costs.

The SLCA is currently $3070 for duplexes or $1535 for all other service attachments. If the estimated cost for a service line exceeds the SLCA, the customer will pay the excess amount.

When a new main extension is required, all the capital costs required to provide service to the customer (main extension, service line and meter) will be input into the economic test and a distinction between service line and main will not be made, therefore eliminating the requirement for the SLCA.

Winter Installation of Services

If FBC (Gas) approves construction in winter frost conditions, all costs associated with the construction will be included in determining the contribution in aid of construction.

The customer will be responsible for spring clean-up on the property. FBC (Gas) personnel will inform the customer about this responsibility at the time of application.

FBC (Gas) may perform repairs of a minor nature due to the inability to perform trench compaction because of frozen soil conditions.

Standard Installation

Service Line Route

FBC (Gas) will designate the entry point to the property and the route the service line will follow to ensure the following:

- Installations meet long-term operating efficiency needs
- Personnel safety
- Customer safety

FBC (Gas) will plan, design, and install all services according to the requirements of the following:

- **FBC (Gas) Tariff** including its General or Standard Terms and Conditions
- **FBC (Vancouver Island) Inc. Tariff**
- **FBC (Whistler) Inc. Tariff**
- **CSA B149.1** *Natural Gas and Propane Installation Code*
- **CSA B149.2** *Propane Storage and Handling Code*
- **CSA Z662** *Oil and Gas Pipeline Systems*
- Policies, specifications, guidelines, procedures, standard drawings, and other approved FBC (Gas) documentation

Whenever possible, the service connection point should be at a right angle to the main or header, and continue in a straight line to the meter location. An offset from the straight running line should not normally exceed 1.5 m.

Additional costs (if any) as a result of a deviation from the standard running line will be at the customer's expense.

- See **Standard Drawings for New and Conversion Services**

Preferred Meter Location

Meters should be located in a visible, accessible location in order to:

- Help emergency response personnel and the public locate meters and service lines.
- Facilitate meter changing, maintenance, and reading.
- Ensure reliability in the system survey.

The meter location must meet all FBC (Gas)and industry standards and codes.

The customer is responsible for ensuring that a meter location meeting FBC (Gas) and industry standards and codes is available.

Additional costs as a result of a deviation from the preferred meter location will be at the customer's expense.

- See **DES 07-17** *Locating Meter Sets*

Caution: Printed documents may not be current. Verify online.

Single Unit Buildings with One Meter

The preferred meter location for a service will be on the outside wall of the building that faces the gas main or header (front wall), or on a connecting sidewall at the location nearest to the main that meets industry code requirements. A customer will not be billed for additional length exceeding 1.5 metres past the front wall to the first safe meter location. Additional charges will apply if the customer requests a meter location beyond the first safe preferred meter location.

The glass dial of the meter must not exceed one metre above the final grade level. A fully enclosed garage attached or located within a building is considered to be part of the building being served. An open post and beam carport is not considered part of the building being served.

- See **Standard Drawings for New and Conversion Services** Figures 1 to 4.

Multi-Unit Buildings with More Than One Meter

The preferred meter manifold location is on the building's outside wall that faces the gas main or header (front wall), or up to 1.5 metres past the front wall on a connecting sidewall. The glass dial of the lowest meter on the manifold must not exceed one metre above the final grade level. Where there is a common wall connecting two premises, it is acceptable to have a meter manifold located on the common wall. It is strongly encouraged to position the meters on a single meter manifold. Individual service laterals from the service header will be treated as service lines.

- See **Standard Drawings for New and Conversion Services** Figures 5 to 13.

If a new service is required to connect three or more customers to a meter manifold, and the estimated service cost exceeds the SLCA, a cost/benefit analysis based on the economic test will be performed. If the analysis indicates a deficiency, the customers will be required to pay a contribution in aid of construction, in addition to the application fee.

The economic test will be applied to multi-unit buildings requiring a service header. If one or two residential customers apply for service to a conversion townhouse, the planner will apply the economic test for the initial and projected future customers identified in the survey. This will ensure fair treatment of all customers connecting within the complex.

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- See **CUS 07-08** *Main Extensions.*

Preferred Meter Location Larger Customers

The preferred meter location for large commercial and/or industrial customers is the first available and acceptable outside location inside the customer's property line, closest to the main. The customer is responsible for supplying the meter pad and protection. The meter pad and protection must meet FBC (Gas)standards.

Existing Service Stubs

If there is an existing service stub, and using it will produce the most efficient service installation, FBC (Gas) will notify the customer of its intention to reuse this stub and the intended meter location.

If the customer requests a route or meter location that prevents the use of the service stub, FBC (Gas) will charge the customer the cost estimate for the service stub abandonment and the new service to the customer's preferred meter location will be the costs estimate minus the SLCA.

- See Standard Drawings for Services Figure 4.

Estimates

The majority of service installations are estimated in CAFE which uses the geo pricing approach. However, when detailed, site-specific cost estimates are required, FBC (Gas) will estimate the direct costs associated with the installation which may include:

- SAP allocated travel, set-up, and site preparation time
- Traffic control
- All surface breaking or cutting and restoration
- Construction materials including pipe, manifolds, meters, regulators, and associated equipment
- Excavation, boring, and restoration materials and services
- Pipe preparation and installation
- Special installation procedures and materials due to anticipated weather and ground conditions (see **Application for New Service** *SLCA* "Winter Installation of Services") or route selection
- Fees and permits

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The rates and applicable overheads will be reviewed periodically to determine whether or not an update is necessary. When an update is deemed necessary, the administrator will update these parameters in the appropriate systems.

Customer Requested Routing

Customer Requested Service Line Routes

If a customer requests a service line route that is different from the FBC (Gas) preferred route, the customer will pay any additional costs between the direct cost estimate for the FBC (Gas) preferred and the customer requested routes, as well as any other costs greater than the SLCA.

Customer Requested Meter Locations

If the customer cannot meet the FBC (Gas) preferred meter location requirements, the meter may be located at the customer requested meter location if it:

- Meets the FBC (Gas) requirements
- Meets industry standards and code requirements
- Is approved by the Installation/Distribution Manager

The customer will pay any additional costs to locate the meter from the FBC (Gas) preferred meter location and the customer requested meter location.

Additional Gas Services

If a customer applies for gas service to an additional premise on the same property, and the additional premise has the same civic address, FBC (Gas) will determine whether another service line to the property or a lateral from the existing service line will be installed. The FBC (Gas) preferred route will be the most economic combination of initial construction costs and long term operating costs that will provide FBC (Gas) with a safe, reliable, and practical system.

If the additional gas service installation is for the same customer (or the spouse, contractor, employee, agent, or partner of the same customer), on the same property, and at the same rate, FBC (Gas) will charge the customer the estimated cost plus the Application Fee of $25 (the SLCA is not applicable).

If the additional gas service installation is for the same customer, on the same property, but at a different rate schedule, FBC (Gas) will treat the additional gas service as a new installation.

Customer Supplied Work

If a customer is responsible for additional costs over and above the connection fee, the customer may reduce these costs by performing some of the work required for the installation. Work will be limited to excavation, backfill, duct installation, or provision of meter protection. Under no circumstances will the customer be permitted to install, join or pressure test gas carrier piping. All work done by the customer must meet FBC (Gas) specifications and a FBC (Gas) inspector may check the site to ensure compliance. There may be charges for this inspection. Once FBC (Gas) and the customer have agreed upon the extent of the work to be done by the customer, the installation will be estimated again with allowances for the customer's work. The new estimated cost, including the charges for the inspection, will be used to determine the required contribution.

Additional Charges

Meter Protection

If FBC (Gas) determines that meter protection is required, the customer will be charged the estimated direct cost for providing meter protection, or the customer may provide meter protection as long as it meets FBC (Gas) standards.

Redesign

If FBC (Gas) completes a standard design for a service line installation, FBC (Gas) may charge the customer for all customer or agent caused incremental costs arising from the redesign.

Aborted Visit

If FBC (Gas) schedules construction work with the customer, FBC (Gas) may bill the customer for each site visit where no work can be done due to obstructions or unsatisfactory site preparation caused by the customer or agent.

Alterations

If a customer requests an alteration to any part of the service or metering apparatus or has affected the operation or safety of any part of the service or meter installation, then an alteration fee may be charged.

Caution: Printed documents may not be current. Verify online.

The customer will be charged the estimated cost for any alteration and reconnection of the service line or meter set.

The customer must be advised of the charges and the scope of the work before work commences. In situations where FBC (Gas) deems that corrective action is required immediately to maintain the integrity of the system and/or for the customer's safety, then the customer will be advised after the work is complete.

Charges - Miscellaneous

The billing of miscellaneous charges is subject to the Installation/Distribution Manager's approval.

Upgrades Resulting from Increased Load

Service Line

If the capacity of an existing service line is insufficient for the added load, FBC (Gas) will upgrade or install a new service line with sufficient capacity. This upgrade will be done at no cost for residential and small commercial customers. The economic test will be applied to large commercial and industrial customers consuming 2000 GJ/yr or greater. The cost of the service line upgrade and the projected incremental annual load will be inputs in the economic test. If the economic test indicates a revenue shortfall, the customer will be required to pay the calculated contribution.

Meter Set

If the capacity of an existing meter is insufficient for the added load, FBC (Gas) will upgrade or install a new meter with sufficient capacity. This upgrade will be done at no cost for all customers.

Request for Increase in Service Pressure

If a customer requests an increase in service pressure to accommodate an additional appliance, or to supply an appliance with an elevated delivery pressure, FortisBC will evaluate the request for feasibility. The existing service line size serving the existing meter shall be considered, along with the regulator vent clearances specified in the B 149 Provincial Gas Code and any other existing gas facilities in the vicinity. Approval from the System Planning Manager is required for requests for delivery pressure greater than 35kPa.

The Customer will be responsible for the cost associated with providing any modification to their building to accommodate the new meter, and

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will also be required to provide any required meter protection that FBC (Gas) deems necessary before the new meter and pressure regulator is supplied. In all circumstances the Customer will be responsible for making the connection between the new meter and pressure regulator back to the piping downstream.

Customer requests for increased delivery pressure deemed practical by FBC (Gas) shall be provided to the customer without cost. If an alteration of a minor nature is required to facilitate the new meter and regulator this too will be provided without cost. .

- See **Upgrades Resulting from Increase Load***Meter Set*
- See **DES 04-01-13** *Distribution Set and Delivery Pressure*.

Abandonment/Supply Cut-Off

FBC (Gas) will abandon service lines when they have no planned usage, or when they are unfit due to age, damage, corrosion, or mechanical failure.

If the customer (or the spouse, contractor, employee, or partner of the customer) requests that a service line to a premises be cut off, and subsequently applies for a new service to new premises on the same property with the same legal description, the new service will be handled as a new service application. The customer may be responsible for additional charges if the initial terms of service have not been met.

If the customer (or the spouse, contractor, employee, or partner of the customer) requests that a service line to a premise be cut off and subsequently applies for a new service to the same premise within one year, the customer will be charged the greater of the costs incurred to terminate or reactivate the customer, or the sum of the minimum monthly charges applicable from the time of termination to reactivation.

- See the FBC (Gas) Inc. and FBC (Gas) (Vancouver Island) Inc. tariffs.

FBC (Gas) will not charge for abandoning a service line unless the work is deemed to be an alteration, or in a special circumstance, such as delayed consumption or meter consolidations.

- See **Additional Charges** *Alterations, Delayed Consumption* and **Meter Consolidations**.

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Meter Consolidations

If a customer requests individual accounts on a single property, or on contiguous properties to be consolidated into a single account, FBC (Gas) will provide this service if the customer agrees to pay the due charges and sign the required release waiving the FBC (Gas) liability for any damages should the customer decide to re-use the abandoned plant downstream of the new meter set. By recovering the out-of-pocket costs, as well as the value of the abandoned pipe, FBC (Gas) can then treat the consolidated accounts as one new customer.

The charges due include:

- Depreciated replacement cost of the plant being abandoned, except the meter
- Estimated cost to the customer for abandoning the pipe and removing the meter sets that will no longer be used.
- Overheads on the above two items
- $25 Application Fee
- Service line costs in excess of the SLCA for residential and small commercial customers.
- Service line costs for large commercial and industrial customers, based on the economic test.

The depreciated replacement cost for abandoned plant will be calculated by estimating the cost to the customer for replacing the abandoned pipe to determine the initial cost (to apply depreciation). The site conditions at the time of construction (ex: whether the pipe was installed before paving and landscaping) must be taken into account when determining the replacement cost. This estimate will be depreciated at a rate of two percent per year for the age of the existing pipe. For example, if the cost to customer estimate is $2000 for replacing pipe installed in 1985, and the replacement occurs in 2005, the depreciated cost is calculated as follows.

2005 – 1985 = 20 years

2% X 20 = 40%

Depreciation = 40% X $2000 = $800

Depreciated replacement value = $2000 – $800 = $1200

Caution: Printed documents may not be current. Verify online.

The customer will be responsible for reconnecting house piping, reactivating equipment, and providing meter set pads and protection meeting FBC (Gas)standards.

The planner will work with the commercial sales representative to ensure the customer is put on the appropriate rate schedule and has reviewed the costs and benefits of the meter consolidation.

If pipe is abandoned that may be used by the customer as house piping, the commercial sales representative is responsible for arranging for the customer to sign the release.

The commercial sales representative will ensure that the customer understands that FBC (Gas) will no longer be responsible for the abandoned pipe or any metering or pressure regulators purchased by the customer from FBC (Gas) or another supplier. Furthermore, it is the customer's responsibility to arrange for maintenance items such as leak survey, cathodic protection, meters, and regulators.

The planner will notify the drafting and records groups to update any drawings and service records. The service record will indicate that a portion of the gas service has been converted to a customer-owned house line and may be live.

If any of the meter sets (located downstream of the consolidated meter) are sold to the customer as informational meters, the planner will:

- Ensure that all FBC (Gas) badges are removed from the meter sets and are forwarded to the measurement technologist in Measurement Technologies.
- Forward to the measurement technologist in Measurement Technologies the customer's name and address, name of commercial sales representative, and name of planner, to be recorded in the meter record system.

Temporary Services

FBC (Gas) considers any service required for less than 12 months as temporary and fully chargeable, unless otherwise stated in the service agreement. A customer requesting a temporary service will pay the cost to customer for the installation and removal of the service line.

Caution: Printed documents may not be current. Verify online.

Delayed Consumption

If a new customer does not consume gas within one year after the service line installation, FBC (Gas) may charge the actual installation cost to the customer of the service line and meter set, less the total of the following:

- The total of the minimum monthly charges billed to the customer to that date **and**
- Any additional costs the customer paid previously

If the actual costs to the customer for the service line installation are not available, a new cost to customer estimate for the installation will be used.

Inactive Services

An inactive service is one with a history of consumption, but no recent consumption, and no expectation of future consumption.

- If FBC (Gas) anticipates no future gas use, the service will be abandoned at the main or header, or at the property line if FBC (Gas) determines that a cut-off at the main is not practical due to pavement, concrete, or other obstacles.
- FBC (Gas) may opt to leave the service gasified and to lock, plug, and tag the above-grade meter cock. FBC (Gas) will apply its leak survey and maintenance policies to gasified but inactive services. FBC (Gas) will confirm the status of each inactive service at least annually.

Transmission Pressure Services (>2070 kPa)

Charges for service lines connected to transmission pressure pipelines are determined by the sum of:

- the costs associated with the tapping of the transmission pressure pipeline and the transmission piping including the pressure reducing facility
- the direct cost estimate of the service line downstream of the pressure reducing facility.

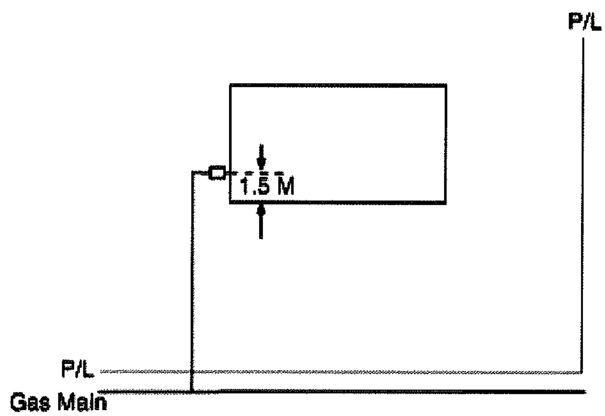
The economic test will be applied to the sum of the above costs and the projected incremental annual load. If the economic test indicates a revenue shortfall, the customer will be required to pay a contribution in aid of construction to eliminate the revenue shortfall.

HST

HST is applicable to all charges.

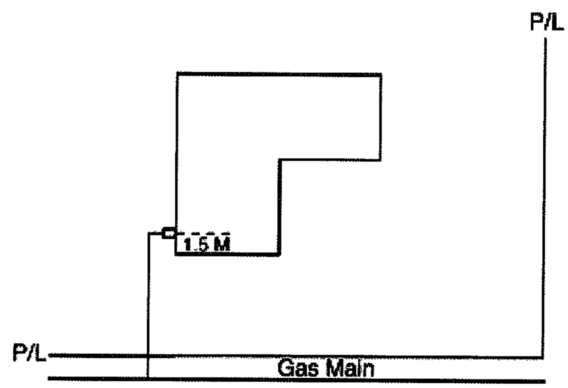
Standard Drawings for Services

Figure 1: Standard Drawing For the FBC (Gas) Preferred Route Residential and Small Commercial to a Single Customer



Design and Construction Reference Items and Charges	
Standard Connection Fee	$25
SLCA	$1535
Non-Standard Connection Fee	$25 + (direct cost estimate - $1535) + HST

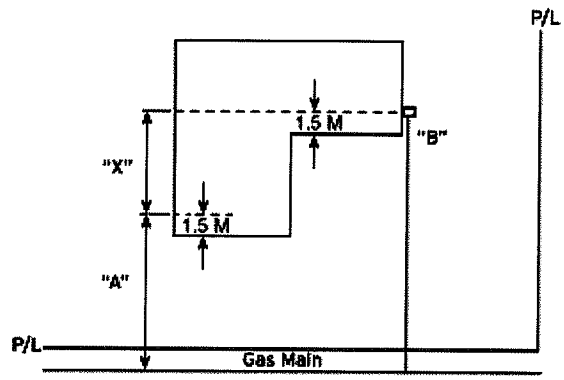
Figure 2: Standard Drawing For the FBC (Gas) Preferred Route for Residential and Small Commercial Services



Design and Construction Reference Items and Charges	
Application Fee	$25
SLCA	$1535
Connection Fee	$25 + (direct cost estimate - $1535) + HST

Caution: Printed documents may not be current. Verify online.

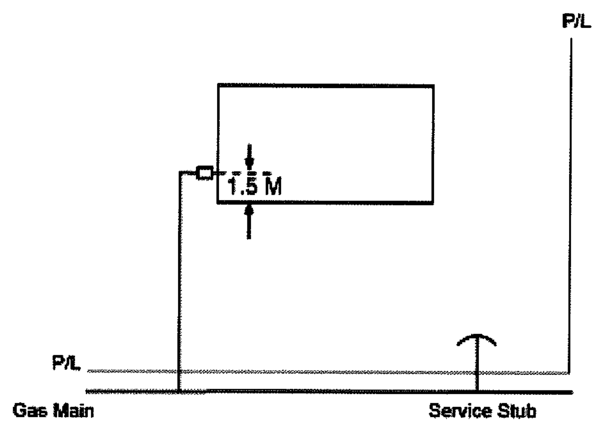
Figure 3: Standard Drawing For the FBC (Gas) Preferred Route for Residential and Small Commercial Services requiring additional footage "B"



Design and Construction Reference Items and Charges	
Application Fee	$25
SLCA	$1535
Connection Fee	$25 + (direct cost estimate - $1535) + additional footage + HST

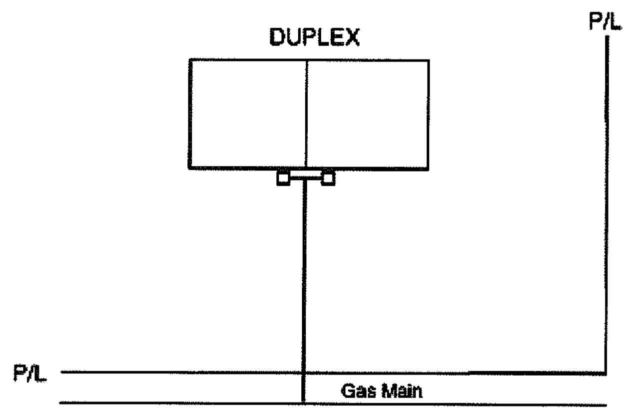
NOTE: "X" represents additional footage

Figure 4: Standard Drawing for FBC (Gas) Preferred Route for Residential and Small Commercial services where the customer requests a route or meter location that prevents the use of the stub service.



Design and Construction Reference Items and Charges	
Standard Connection Fee	$25
SLCA	$1535
Non-Standard Connection Fee	$25 + (direct cost estimate - $1535) + HST
Service Stub Abandonment	$650

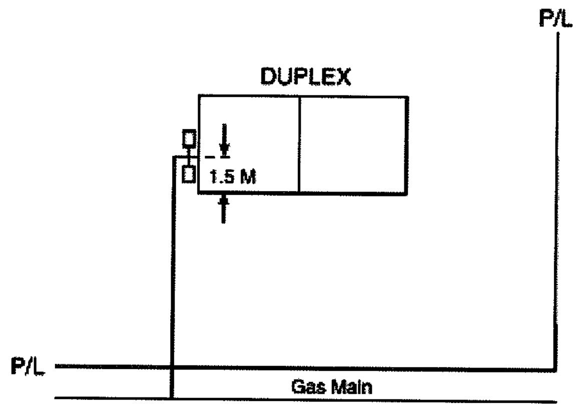
Figure 5: Standard Drawing For FBC (Gas) Preferred Route for Residential and Small Commercial Services For Duplexes with Strata Designation



Design and Construction Reference Items and Charges	
Application Fee	2 x $25
SLCA	$3070
Connection Fee	(2 x $25) + (direct cost estimate - $3070) + HST

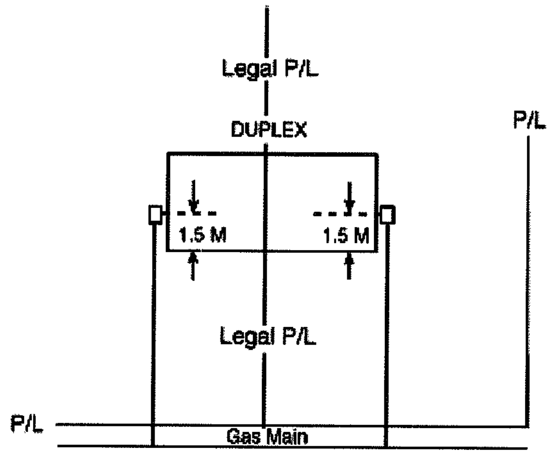
Caution: Printed documents may not be current. Verify online.

Figure 6: Standard Drawing For FBC (Gas) Permissible Route For Resdential and Small Commercial Services, For Duplexes With Strata Designation



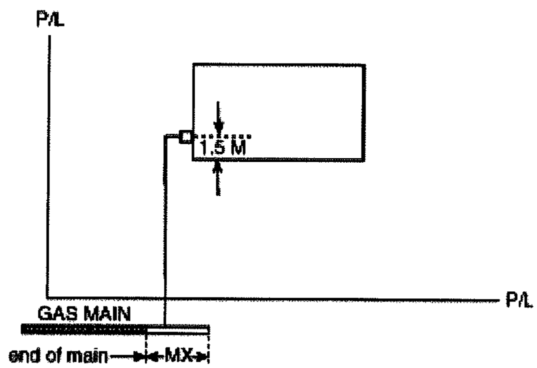
Design and Construction Reference Items and Charges	
Application Fee	2 x $25
SLCA	$3070
Connection Fee	(2 x $25) + (direct cost estimate - $3070) + HST

Figure 7: Standard Drawing For FBC (Gas) Preferred Route for Residential and Small Commercial Services, For Duplexes with a Non-Strata Designation



Design and Construction Reference Items and Charges	
Application Fee	$25 each
SLCA	$1535 each
Connection Fee *each service is treated like an individual service line	$25 + (direct cost estimate - $1535) + HST

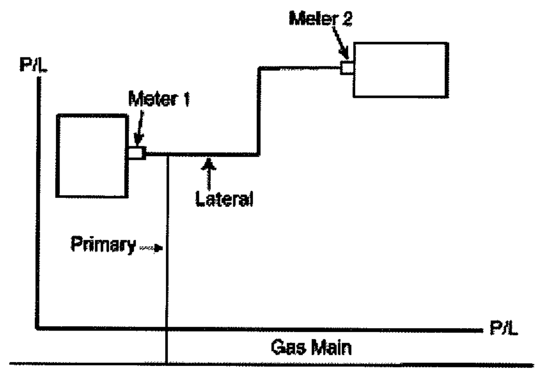
Figure 8: Standard Drawing For the FBC (Gas) Preferred Route for Residential and Small Commercial Services, For a Single Customer with a Main Extension



Design and Construction Reference Items and Charges	
Application Fee	$25
SLCA	N/A
Connection Fee	$25 + ET Contribution + HST

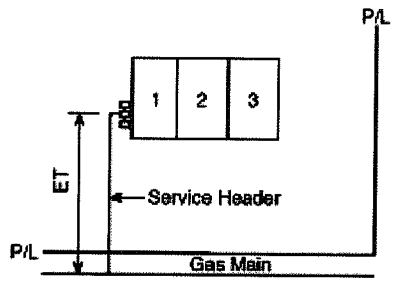
Economic Test is required. All estimated direct costs to provide service to the customer (main extension, service line and meter) will be input into the Economic Test and a distinction between the service line and main will not be made, therefore eliminating the requirement for the SLCA.

Figure 9: Standard Drawing For the FBC (Gas) Preferred Route for Residential and Small Commercial Services, For a Service Extension to Two Risers, Same Customer on the Same Rate Schedule and Property



Design and Construction Reference Items and Charges	
Application Fee	2 x $25
SLCA	$1535
Connection Fee	(2 x $25) + full cost of lateral service + (direct cost estimate for primary service - $1535) + HST

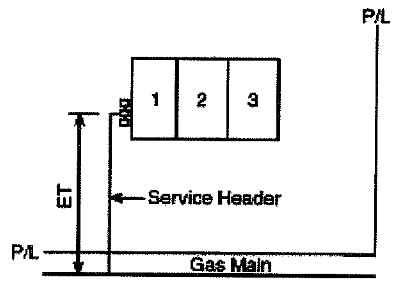
Figure 10: Standard Drawing For FBC (Gas) Preferred Route for Residential and Small Commercial Services, Multi-Unit Building



Design and Construction Reference Items and Charges	
Application Fee	3 x $25
SLCA	$3070
Connection Fee	(3 x $25) + (direct cost estimate - $3070) + HST or (3 x $25) + ET Contribution + HST

If the estimated cost of the service exceeds the SLCA, a cost benefit analysis based on the Economic Test will be performed.

Figure 11: Standard Drawing For FBC (Gas) Preferred Route for Large Commercial and Industrial Services, Multi-Unit Building



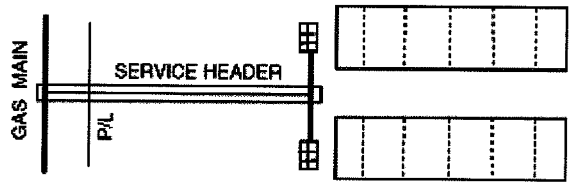
Design and Construction Reference Items and Charges	
Application Fee	3 x $25
SLCA	Not Applicable
Connection Fee	(3 x $25) + ET Contribution + HST

Economic Test is required. All estimated direct costs to provide service to the customer (main extension, service line and meter) will be input into the Economic Test and a distinction between the service line and main will not be made, therefore eliminating the requirement for the SLCA.

Standard Drawing for FBC (Gas) Preferred Route for Residential and Small Commercial Services, Multi-Unit Building with Three or More Gas Meters at Two or More Locations

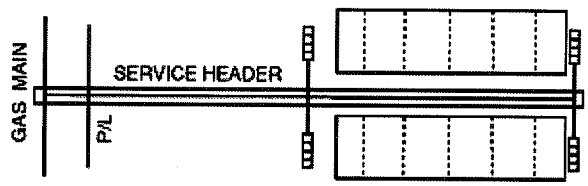
The preferred method and acceptable alternative for serving multi-unit building customers are shown in descending order of preference, in all configurations below. The Economic Test is required in all configurations.

Figure 12: Meters Banked at One End of the Building



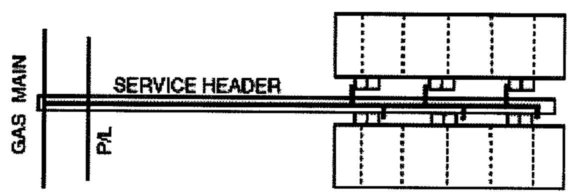
Application Fee	$25.00 x 12 gas meters
Connection Fee	(12 x $25) + ET Contribution + HST

Figure 13 Meters Banked at Both Ends of the Building



Application Fee	$25.00 x 12 gas meters
Connection Fee	(12 x $25) + ET Contribution + HST

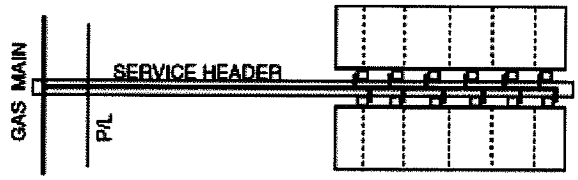
Figure 14 Two Meters Installed at Two-meter Banks from Branches off the Service Header



Application Fee	$25.00 x 12 gas meters
Connection Fee	(12 x $25) + ET Contribution + HST

Caution: Printed documents may not be current. Verify online.

Figure 15: Individual Meters installed from Branches off the Service Header at Three or More Locations



Application Fee	$25.00 x 12 gas meters
Connection Fee	(12 x $25) + ET Contribution + HST

Attachment 153.3

REFER TO LIVE SPREADSHEET

Provided in electronic format only

(accessible by opening the Attachments Tab in Adobe)

Attachment 154.1

REFER TO LIVE SPREADSHEET

Provided in electronic format only

(accessible by opening the Attachments Tab in Adobe)

Attachment 155.6

REFER TO LIVE SPREADSHEET

Provided in electronic format only

(accessible by opening the Attachments Tab in Adobe)

Attachment 156.1.1

REFER TO LIVE SPREADSHEET

Provided in electronic format only

(accessible by opening the Attachments Tab in Adobe)

Attachment 177.9

Educational Video - viewable at www.fortisbc.com/makeyuckuseful

Navigation for renewable natural gas

Natural gas
- For homes
  - Rebates & offers
    - **Renewable natural gas**
      - **Sign up**
      - **Environmental benefits**
      - **Frequently asked questions**
      - **Details & Eligibility**
      - **Win a Whistler eco-tour prize pack**

Renewable natural gas

When bacteria break down organic waste and manure, they create biogas. We're capturing and purifying it to provide you with renewable natural gas, a locally produced, carbon-neutral energy source.

FortisBC residential customers are among the first in North America who can choose renewable natural gas, supplied by their utility, for their home.

Sign up for renewable natural gas <link to sign up page>, and for an extra $0.53 per gigajoule—about $4 per month for an average home—10 per cent of the natural gas you use will be designated renewable natural gas. We'll then inject the equivalent amount of renewable natural gas into our system.

Sign up & enter to win
Sign up before July 15, and you could win a Whistler eco-tour prize pack.

- **Sign up now!**

Questions?

- Read the FAQs
- Call 1-888-224-2710

Learn how bacteria make yuck useful and create renewable natural gas:

Video <max 460 wide>

Renewable natural gas sources in BC
We're working with local businesses and municipalities.

>Learn more

Certified carbon neutral by Offsetters
A carbon-neutral source of energy, renewable natural gas has many environmental benefits <link to environmental benefits page>. Using renewable natural gas displaces conventional natural gas and is a renewable fuel source.

And because it is carbon neutral, subscribers get a 10 per cent credit on the BC carbon tax!

Signing up is simple

If you are a residential FortisBC customer in the Lower Mainland, Fraser Valley, Inland (Interior and North) or Columbia (Kootenays) service areas and not enrolled with a gas marketer, you can sign up for renewable natural gas.

Call 1-888-224-2710 or sign up through your Account Online. Visit the Sign up <link to sign up page> page for details.

Questions?

Read the FAQs <link to FAQ>, email **renewablenaturalgas@fortisbc.com** or call **1-888-224-2710**.

Sign up for renewable natural gas

By signing up for renewable natural gas from FortisBC, you're supporting sustainable energy for BC. Here's how to join:

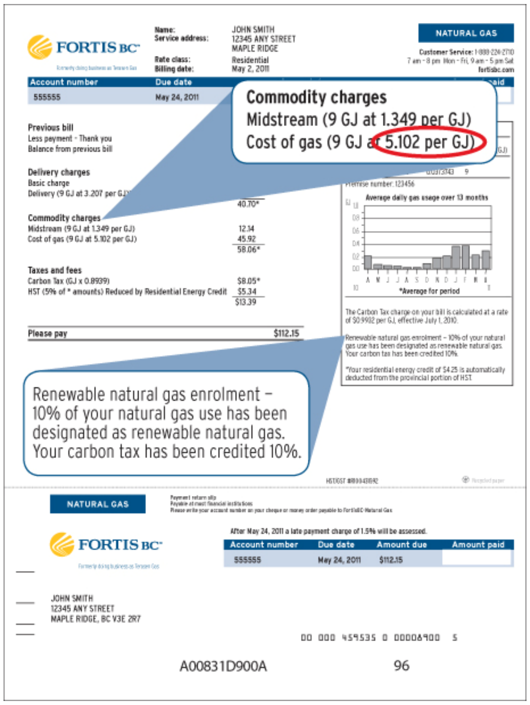
Questions?

- Read the FAQs
- Call 1-888-224-2710

1. Check your eligibility <link to details and eligibility>: you must be a residential customer in the Lower Mainland Valley, Inland (Interior and North) or Columbia (Kootenays) service areas, and not currently enrolled with a gas marketer.
2. Log in to Account Online to apply. Have your FortisBC natural gas account number ready.
3. Once logged in, a link on the left-hand side of your screen will guide you through the sign-up process. You may also enroll by calling **1-888-224-2710**.
4. Get confirmation of enrolment. If subscriptions for renewable natural gas exceed supply, interested customers can be waitlisted to be notified of available spots.

Sign up before July 15, 2011 for a chance to win a Whistler eco-tour prize pack! Read the contest rules & details <link to contest page> before entering.

Renewable natural gas will show up as a line item on your bill, like this:



Environmental benefits of renewable natural gas

Made from an abundant renewable resource—organic waste—renewable natural gas can help reduce your carbon footprint:

- displaces the use of conventional natural gas with a renewable source of energy
- considered carbon-neutral because it is produced from organic waste and captures methane that would otherwise escape into atmosphere, reducing equivalent carbon dioxide emissions by up to 21 times[1]
- reduces the greenhouse gas emissions of a typical British Columbia home by about half a tonne per year[2], the equivalent of diverting 158 kg of waste from our landfills through recycling[3]
- contributes to developing renewable and sustainable energy in BC
- helps BC meet its greenhouse gas emission targets

Sign up & enter to win
Sign up before July 15, and you could win a Whistler eco-tour prize pack.

➢ **Sign up now!**

Join us. Sign up today for a more sustainable energy future for BC.

Offsetters, Canada's leading carbon management solutions provider, independently reviewed FortisBC's renewable natural gas offering. Offsetters assessed the expected lifecycle emissions savings of renewable natural gas and confirmed that renewable natural gas meets the requirements to be granted Offsetters' Carbon Neutral Product status in BC. For more information, read Offsetters' certification assessment of renewable natural gas. <link to PDF>

[1] Intergovernmental Panel on Climate Change's (IPCC) *Fourth Assessment Report* (2007), Table 2.14, available at http://www.ipcc.ch/publications_and_data/ar4/wg1/en/ch2s2-10-2.html#table-2-14.

[2] Renewable natural gas displaces fossil fuel natural gas that has a carbon intensity of 50 kg/ CO_2e (equivalent carbon dioxide). Based on an average residential natural gas consumption of 95 GJ/year, 10 per cent renewable natural gas = 9.5 GJ. 9.5 GJ x 0.05 = 0.475 tonne CO_2 reduction.

[3] Calculated using the Greenhouse Gas Equivalencies Calculator at http://www.epa.gov/cleanenergy/energy-resources/calculator.html

Frequently asked questions

[List frequently asked questions in expanding list format]

Sign up & enter to win
Sign up before July 15, and you could win a Whistler eco-tour prize pack.

➢ **Sign up now!**

Renewable natural gas sources in BC
We're working with local businesses and municipalities.

>Learn more

What is renewable natural gas?

Renewable natural gas is derived from biogas, which is produced from decomposing organic waste from landfills or agricultural waste (such as cow or chicken manure). When captured and cleaned, renewable natural gas (also called biomethane) can be injected into the existing natural gas pipeline system. It is a carbon-neutral substitute to conventional natural gas and can be used in all natural gas appliances.

How does it work?

Once upgraded, biomethane is interchangeable with natural gas. No changes are required to customer appliances, and biomethane can be delivered using our existing pipeline infrastructure.

How do I sign up for renewable natural gas?

You can sign up <link to sign up page> for renewable natural gas by logging in to your Account Online, and clicking on the renewable natural gas enrolment link.

Alternatively, you can call us at **1-888-224-2710** to sign up. If your residence is eligible, your enrolment will be complete and effective on the 1st of the following month. Note that if you apply within one week of the start of the next month, your successful enrolment will commence the following month.

How will I receive renewable natural gas?

Because renewable natural gas is interchangeable with conventional natural gas, it can be injected into FortisBC's natural gas distribution system, displacing conventional natural gas. Customers who sign up for renewable natural gas continue to draw conventional natural gas from the pipeline, but will have a portion of their consumption designated as renewable natural gas. We'll then inject the equivalent amount of renewable natural gas into our system.

If I sign up for renewable natural gas and my neighbour doesn't, will we both receive a mixture of natural gas and biomethane to our homes?

The location of production facilities will determine where renewable natural gas will physically be introduced to the FortisBC system. Customers signing up for the renewable natural gas rate may not receive actual renewable natural gas at their home, but instead are contributing to the cost of injecting the same amount of renewable natural gas into FortisBC's system. Thereby, you are displacing conventional natural gas and reducing your personal carbon footprint.

Is it safe?

Yes. Renewable natural gas is composed primarily of methane – the same primary component of natural gas.

Will my appliances be affected?

No. FortisBC will ensure that renewable natural gas meets the same quality standards as conventional natural gas. There will be no noticeable difference.

Do I need any special equipment?

No. FortisBC will ensure that renewable natural gas meets the same quality standards as conventional natural gas. There will be no noticeable difference.

Will my Equal Payment Plan (EPP) amount change if I sign up for renewable natural gas?

There will be no immediate change to your Equal Payment Plan installment amount. However, the plan will still be reviewed quarterly against current usage and rates, and may be adjusted at those times.

Will I still have to pay the carbon tax if I sign up for the renewable natural gas rate?

Since renewable natural gas is considered carbon neutral, the BC carbon tax amount will be credited by 10 per cent. The revised amount will appear on your FortisBC natural gas bill each month.

Is FortisBC the first to offer such a program?

In 2010, FortisBC became the first utility in Canada to receive approval from its regulator, the BC Utilities Commission, to invest in biogas upgrading and interconnection infrastructure in order to inject renewable natural gas produced through decomposition of organic materials into the natural gas distribution system.

FortisBC is the first utility in North America to introduce a renewable natural gas offering to residential customers.

What are the greenhouse gas (GHG) benefits?

Renewable natural gas is considered carbon neutral. It will help reduce GHG emissions in BC by displacing conventional natural gas, which has a carbon intensity of 50 kg of carbon dioxide per gigajoule. Additionally, by capturing methane that would otherwise be released to atmosphere, equivalent carbon dioxide emissions may be reduced by up to 21 times.[4]

When will the program be expanded to other regions and rate classes?

FortisBC will phase in renewable natural gas as supplies become available and customer interest grows. Renewable natural gas is currently available to residential Rate 1 customers in the Lower Mainland, Inland (Interior and North) and Columbia (Kootenays) regions.

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[4] Intergovernmental Panel on Climate Change's (IPCC) *Fourth Assessment Report* (2007), Table 2.14, available at http://www.ipcc.ch/publications_and_data/ar4/wg1/en/ch2s2-10-2.html#table-2-14.

Future phases are planned to expand the offering to commercial customers and to other service areas in British Columbia.

What happens if I move?

You may elect to remain on the Renewable Natural Gas rate if your new residence is eligible.

Don't see an answer to your question? Call us: 604-592-7844.

Details & eligibility

You must be a residential customer (single family or separately metered multi-family) located in the Lower Mainland or Fraser Valley, Inland (Interior and North), or Columbia (Kootenays).

This offer is not available on Vancouver Island, the Sunshine Coast, in Whistler, Revelstoke or Fort Nelson.

Customers must not currently be enrolled with a gas marketer.

Sign up & enter to win
Sign up before July 15, and you could win a Whistler eco-tour prize pack.

- **Sign up now!**

Questions?
Where does RNG come from? What does 10% look like?

- Read the FAQ

Summary of rate calculation

Only your cost of gas will change on your bill. Customers who sign up for renewable natural gas will be moved from the residential rate <link to rate schedule 1> to the renewable natural gas rate <link to rate schedule 1B>. The rate will now be 10 per cent renewable natural gas cost and 90 per cent standard cost of gas. Since renewable natural gas is considered carbon neutral, the BC carbon tax amount on your bill will be credited by 10 per cent.

Example below:

Cost of gas as of Apr 1, 2011 (adjusted quarterly)*		$4.568 GJ x 90%
Renewable natural gas cost as of Jan 1, 2011 (adjusted annually)*		$9.904 GJ x 10%
Renewable natural gas rate	subtotal:	$5.102 GJ

At today's prices, this works out to $0.53 more per gigajoule or about $4 more per month based on the average use of 95 GJ per year.

**Renewable natural gas costs will be set on annually with a January 1 effective date. The standard cost of gas will remain subject to quarterly rate adjustments, therefore, the resulting renewable natural gas rate that you will see on your bills could change up to four times a year as the standard cost of gas changes.*

Start & end dates
Enrolment will be effective the first of the month. Please note that if the application is made within one week of the start of the month, it will be completed for the following month.

Customers can choose to return to the residential rate at any time and requests will be processed within one week.

There are no fees associated with moving from one rate to the other.

Win a Whistler eco-tour prize pack

Sign up for renewable natural gas before July 15, 2011, and you'll be entered to win a Whistler eco-tour prize pack valued at $955, including:

- Two passes for a Ziptrek Eagle Tour in Whistler
- One $200 gift card for Araxi restaurant
- A one-night stay for two at the Four Seasons Whistler (parking included)

The prize will be drawn July 22, 2011 in Surrey, BC, and the winner will be contacted by phone. Please read the contest rules below.

Contest rules:
[Insert contest rules]

Web Banner

Postcard (Front)

You're already making a difference

Help reduce your carbon footprint even more with renewable natural gas

FORTIS BC™

Postcard (Back)

Bacteria make yuck useful

Sign up today!

Renewable natural gas stops waste from going to waste.

Dear Vancouver resident:

One day, Vancouver hopes to be the greenest city in the world. By 2020, we want to reduce community-based greenhouse gas emissions by 33 per cent from 2007 levels, and we need your help to get there.

Last summer we asked you for ideas on how we can reach our goals. One Vancouverite responded:

> *Separate organic matter out of the waste stream and convert it to biogas: When food scraps and organic matter decompose in landfills, methane, a powerful greenhouse gas, is created. If captured properly, methane can be used as a fuel source (known as biogas)....*

FortisBC is now making yuck useful by capturing biogas and upgrading it to renewable natural gas. Sign up now at fortisbc.com/makeyuckuseful to reduce your carbon footprint and support local, carbon-neutral renewable natural gas.

Together we can make Vancouver the greenest city in the world by 2020!

Sincerely,

City of Vancouver & FortisBC

CITY OF VANCOUVER | VANCOUVER GREEN CAPITAL

Printed on 100% post consumer recycled paper.

Welcome Letter Envelope

FORTIS BC™

16705 Fraser Highway,
Surrey, BC V4N 0E8

Mr. John Q. Public
Client Corporation
123 Avenue Street
Suite 00000
City, Province
A1A 1A1

Welcome to renewable natural gas

11-041.11

Welcome Letter

Welcome to renewable natural gas

You're now part of a clean energy revolution: **making yuck useful**, supporting sustainable energy for British Columbia and reducing your carbon footprint.

Consider yourself an energy pioneer—you're among the first customers of a regulated utility in North America to choose renewable natural gas, which is made from biogas captured when bacteria break down organic waste. Just by signing up, you're helping make this energy option possible.

Your participation not only displaces conventional natural gas with renewable natural gas but also prevents methane emissions from entering our atmosphere, where they can be 21 times more harmful than carbon dioxide.[1] We estimate that in the first year alone, subscribers to renewable natural gas will collectively save about **5,000 tonnes of greenhouse gases**[2]—the equivalent of diverting 1,742 tonnes of waste from our landfills through recycling.[3]

The best part is, you don't need to do anything differently. FortisBC designates 10 per cent of your home's natural gas usage as renewable, and injects an equivalent amount into our system from local renewable natural gas projects.

Choosing renewable natural gas sends a positive message to your community. You care about energy, the environment and the future. So don't be shy: spread the word to family, friends, colleagues and neighbours. Talk, email or tweet about **fortisbc.com/makeyuckuseful**. The more people who know about renewable natural gas, the bigger the difference we can make.

Thank you for signing up and supporting a more sustainable energy future for B.C.

FortisBC

[1]Intergovernmental Panel on Climate Change's (IPCC) Fourth Assessment Report (2007), Table 2.14, available at *www.ipcc.ch/publications_and_data/ar4/wg1/en/ch2s2-10-2.html#table-2-14.*

[2]Based on 100,000 gigajoules of renewable natural gas displacing fossil fuel natural gas that has a carbon intensity of 50.3 kg/CO_2e *(see Methodology Manual, Reporting Regulations for Greenhouse Gas Reduction Act (Dec. 2009), available at www.env.gov.bc.ca/cas/mitigation/ggrcta/reporting-regulation/pdf/methodology-manual.pdf).* 100,000 GJ x 0.05 = 5,000 tonnes.

[3]Calculated based on 5,000 tonnes (5,000 metric tons) CO_2e using the US EPA's Greenhouse Gas Equivalencies Calculator: *www.epa.gov/cleanenergy/energy-resources/calculator.html*

FORTIS BC™

Bookmark Giveaway

PB1: Lil' Bloomer Bookmark (2.25x7.75") **Shape:** Foot **Color:** Royal

Forest

Sage

Chartreuse

Lime

Powder

Light Blue

Teal

Royal

Violet

Lavender

Burgundy

Pink

Cranberry

Terra Cotta

Salmon

Orange

Desert Orange

Coffee

Yellow

Cream

Front

The paper foot is embedded with annual and perennial wildflower seeds.

Plant Me!

Plant under a thin layer of soil and water daily until seedlings are well-established.

planting instructions

Help reduce your carbon footprint with renewable natural gas

FORTIS BC™

Front with attached shape

Plant Me!

planting instructions

Help reduce your carbon footprint with renewable natural gas

FORTIS BC™

Back

You're already making a difference

Find out more at **fortisbc.com/makeyuckuseful** and stop waste from going to waste.

FORTIS BC™

Word Magnet (Part of welcome package)

Window Cling (Part of welcome package)

This home is for renewable natural gas

FORTIS BC™

FortisBC Biomethane: window cling

Solo Banner

34.125 in

85.25

93 in

d.

FORTIS BC™

Help reduce your carbon footprint with renewable natural gas

Find out more at
fortisbc.com/makeyuckuseful
and stop waste from going to waste.

Solo Banner

34.125 in

FORTIS BC

Bacteria make yuck useful

Find out more at
fortisbc.com/makeyuckuseful
and stop waste from going to waste.

85.25

93 in

Facebook Ad

Win a Whistler eco-tour

fortisbc.com/makeyuckuseful [URL]

Renewable natural gas from FortisBC is here. Sign up by July 15, 2011 to enter to win a Whistler eco-tour for two. Learn more today.

Early Subscriber E-mail (Sent to interested customers)

Subject line: **Sign up for renewable natural gas**

Thank you for signing up to receive news about renewable natural gas from FortisBC. Through your interest in renewable natural gas made from organic waste, you've shown your support for making a difference in the environment and future of energy in BC.

Today, we're excited to share the news that enrolment for renewable natural gas is open. To show our appreciation for your support, we're giving you an early opportunity to sign up for renewable natural gas, before we make our formal announcement to the general public on June 15, 2011.

It's easy to sign up: visit **fortisbc.com** and log in to Account Online, or call **1-888-224-2710**.

And if you sign up before July 15, 2011, you'll also get a chance to win a fabulous Whistler eco-tour prize pack* that includes *one night's accommodation at the Four Seasons Whistler, dinner at Araxi, and Ziptrek passes for two!*

For full contest details and rules, visit our renewable natural gas section at **fortisbc.com/makeyuckuseful**.

Sincerely,

Your renewable natural gas team

**Existing FortisBC natural gas customers who sign up for renewable natural gas between Monday, June 13, 2011 and Friday, July 15, 2011, will be automatically entered into contest. Prize pack consists of one night's accommodation for two at the Four Seasons Whistler, one gift card to Araxi restaurant and two passes to Ziptrek Eagle Tours. Approximate retail value of entire prize pack is $955. Prizes are non-transferable and not redeemable for cash. One winner will be chosen from a random draw on July 22, 2011. Winner will be contacted directly and must answer a skill-testing question. Winner must also sign a release in favour of FortisBC Energy Inc. and its affiliates and each of their respective agents and employees from any and all claims and liability arising out of injury, death, accident, loss, damage, or expense suffered or incurred by the winner directly or indirectly relating to the conduct of the contest or the award or use of the prize pack. Odds of winning depend on number of entries received. Employees or agents of FortisBC Energy Inc., FortisBC Inc. and their immediate families are not eligible to win.*

Renewable natural gas

FortisBC is making yuck useful. When bacteria break down organic waste, they produce biogas that can be captured and upgraded to pipeline-quality renewable natural gas. FortisBC residential customers can now sign up for renewable natural gas. It’s a simple way to reduce your carbon footprint even more.

City of Vancouver E-Newsletter (June 15) Content

Reduce your carbon footprint even more

This month FortisBC launches renewable natural gas. It's made when bacteria break down organic waste, producing biogas that can be captured and upgraded to pipeline-quality renewable natural gas. Renewable natural gas not only makes yuck useful but also helps reduce methane emissions in the atmosphere. For about $4 per month for an average Vancouver household, FortisBC will designate 10% of the natural gas you use as renewable and inject an equal amount of renewable natural gas into its pipelines. Since it's carbon neutral, subscribers get a 10% credit on the carbon tax, too. Learn how you can sign up today.

Bill Message (June 15-30)

Renewable natural gas is now here! Be among the first to subscribe to carbon-neutral, locally made renewable natural gas from FortisBC. Sign up at fortisbc.com/renewablenaturalgas or call 1-888-224-2710.

Quick Connect Residential Newsletter (Insert)

Quick Connect

An energy newsletter for you

FORTIS BC™

Spring 2011

Renewable natural gas: a first in B.C.

In the evolving world of energy, biomethane—otherwise known as renewable natural gas—is a sustainable, clean energy source that's abundantly available. Providing this renewable energy along with traditional natural gas is one way FortisBC is helping sustainable energy become a reality.

Be among the first!

Soon, FortisBC will introduce a renewable natural gas product*—we're the first utility in North America to do so.

You'll have the option of designating 10 per cent of the natural gas your household uses as renewable natural gas. We'll then inject the equivalent amount of renewable gas into our system. Sign up now to be notified when renewable natural gas is available. Just send an email to **biogasprogram@fortisbc.com** with "renewable natural gas" in the subject line. We'll then email you when the product is available.**

Truly renewable

When organic waste decomposes it produces an energy rich gas called biogas. Biogas can be captured from waste at farms, landfills and wastewater treatment plants. When cleaned and upgraded to biomethane, we inject it into our natural gas system to be used for home heating, electricity or as a transportation fuel. Today, we get biomethane from an Abbotsford agricultural waste facility and, soon, a Salmon Arm landfill.

In the first year, it's estimated that greenhouse gas savings from the program will be equivalent to removing 2,000 vehicles from our roads. Learn more at **fortisbc.com/biogas**.

A common name. A shared vision.

In July 2010, Terasen Gas and FortisBC began sharing one vision and one leadership. In March 2011, Terasen Gas and FortisBC began operating under one name, FortisBC. Combined, we deliver energy to more than 1.1 million customers in 135 communities where we live and work. Visit **fortisbc.com** to learn our story.

In this issue:

** This offering will not be available on Vancouver Island, the Sunshine Coast, in Whistler, Revelstoke or Fort Nelson.*
*** Currently, we have two sources of biomethane and are developing others. This means supplies are limited. Once we reach the limit, interested customers will be added to a wait list to be notified of the next available supply.*

Tweets

Hash tag for all tweets: #MakeYuckUseful
Ow.ly link to FortisBC RNG webpage: http://ow.ly/5cpDE
Full link: www.FortisBC.com/MakeYuckUseful

Our new Renewable Natural Gas product launches June 15. We'll be sharing information about it in advance using the hash tag #MakeYuckUseful

What's renewable natural gas? Here's a great overview of how its created by cows in #Abbotsford http://ow.ly/4EK5j via @theprovince #MakeYuckUseful

Renewable Natural Gas captures & uses greenhouse gases that would otherwise be lost directly into the atmosphere. #MakeYuckUseful

Want to be one of the first to know about our #biogas offerings? Email us at biogasprogram@fortisbc.com to sign up for updates. #MakeYuckUseful

Biomethane - noun: renewable natural gas made from organic sources. Learn more at http://ow.ly/5cpDE #MakeYuckUseful

Renewable Natural Gas customers have the option of designating a portion of their #natgas as renewable #MakeYuckUseful

Sources of renewable natural gas include landfills & farms (cow & chicken manure). There's no lack of supply; it replenishes all of the time! #MakeYuckUseful

To sign up for our new Renewable Natural Gas product, visit FortisBC.com/MakeYuckUseful

By capturing methane that otherwise escapes into atmosphere, equivalent CO2 emissions are reduced by as much as 20 times. #MakeYuckUseful

Renewable #natgas customers reduce CO2 emissions by displacing conventional natural gas with a carbon neutral product. #MakeYuckUseful

News Release (June 23, 2011)

FortisBC launches renewable natural gas program for residential customers

June 23, 2011

Renewable natural gas will help British Columbia fight climate change

SURREY, BC – FortisBC announced today it has launched its renewable natural gas product offering for residential customers in the Lower Mainland, Fraser Valley, Interior and the Kootenays. Eligible customers now have the option of designating 10 per cent of their household's natural gas usage as renewable natural gas. FortisBC will then inject an equivalent amount of renewable natural gas into its distribution system from local renewable natural gas projects. Customers will be subscribed on a first-come, first-served basis, for about an additional $4 per month, based on an average annual consumption of 95 gigajoules (GJs).

"I want to encourage our customers to sign up for renewable natural gas. By signing up, customers are helping create a more sustainable future for our province, reducing their carbon footprint and supporting a carbon-neutral B.C.-made product," said Doug Stout, vice president, energy solutions and external relations, FortisBC.

The only portion of the bill that would change for customers who subscribe to renewable natural gas is the cost of gas. Their cost of gas will now be made up of 10 per cent of the renewable natural gas cost and 90 per cent of the standard cost of gas. Subscribers will not be locked into a contract and can opt-out at any time at no cost.

"FortisBC is making it easy for families to choose a greener, more sustainable way to heat and power their homes and take action on climate change," said Rich Coleman, minister of energy and mines. "This renewable fuel of the future will also help the Province to reduce harmful greenhouse gas emissions."

As renewable natural gas is also considered carbon neutral in B.C., subscribers' carbon tax will be credited by 10 per cent. FortisBC's renewable natural gas offering was recently granted Carbon Neutral Product status by Offsetters in B.C., Canada's leading carbon management solutions provider, after assessing the expected lifecycle emissions savings of the program.

"I commend FortisBC for being the first utility in North America to offer renewable natural gas to residential customers," said James Tansey, CEO of Offsetters. "It's an innovative approach that allows their customers to take action on climate change in a simple and cost-effective way."

Renewable natural gas is created by capturing biogas from sources such as landfills and agricultural waste, and then upgrading it to pipeline-quality gas, before being added to FortisBC's distribution system. Renewable natural gas is also interchangeable with conventional natural gas, so FortisBC can use its existing pipelines and changes are not required to customers' appliances. FortisBC estimates that the total greenhouse gas savings in the program's first year will be about 5,000 tonnes, equal to removing almost 1,000 cars off the road each year or keeping 3.8 million pounds of waste out of landfills, based on delivering 100,000 GJ of renewable natural gas to the FortisBC distribution system.

As additional supply becomes available later this year, FortisBC expects to be able to expand the offering to more residential customers. The company also hopes to be in a position to make the product offering available to commercial customers in 2012 throughout the Lower Mainland, Fraser Valley, Interior and the Kootenays. As a demonstration of potential commercial use of renewable natural gas, Central Heat Distribution Limited (CHDL) recently began purchasing the first 1,000 GJs of their commitment to designate 10,000 GJs of the natural gas in their operations as renewable natural gas from FortisBC. CHDL's district energy system serves downtown Vancouver businesses and residents, relying on natural gas to generate thermal energy through its natural gas boilers.

For more information about FortisBC's renewable natural gas offering, visit fortisbc.com/renewablenaturalgas.

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fortisbc.com
twitter.com/fortisBC
youtube.com/fortisBC

Attachment 188.1

(A) Gas Plant in Service Additions - Schedule 44 (2011), Schedule 47 (2012) & Schedule 50 (2013)

BCUC Acct	Particulars	Additions	AFUDC	Capitalized Overhead	Total
	2011 Gas Plant in Service Additions - Schedule 44				
418-20	Purification Equipment - Upgrader	$ 1,547	$ 60	$ -	$ 1,607
418-10	Purification Equipment - Upgrader Overhaul	387	15	-	402
	Total Upgrader	1,934	75	-	2,009
475	Bio Gas Mains	120	10	57	187
474	Bio Gas House Regulators & Meter Installation	1,129	19	533	1,681
478	Bio Gas Meters	21	19	-	40
	Total Interconnection Facilities	1,270	48	590	1,908
	Total Bio Gas Plant Additions	$ 3,204	$ 123	$ 590	$ 3,917
		A-1			
	2012 Gas Plant in Service Additions - Schedule 47				
418-20	Purification Equipment - Upgrader	1,650	-	-	$ 1,650
418-10	Purification Equipment - Upgrader Overhaul	413	-	-	413
	Total Upgrader	2,063	-	-	2,063
475	Bio Gas Mains	203	-	71	274
474	Bio Gas House Regulators & Meter Installation	406	-	141	547
478	Bio Gas Meters	406	-	-	406
	Total Interconnection Facilities	1,015	-	212	1,227
	Total Bio Gas Plant Additions	$ 3,078	$ -	$ 212	$ 3,290
		A-2			
	2013 Gas Plant in Service Additions - Schedule 50				
418-20	Purification Equipment - Upgrader	$ 2,050	$ -	$ -	$ 2,050
418-10	Purification Equipment - Upgrader Overhaul	513	-	-	513
	Total Upgrader	2,563	-	-	2,563
475	Bio Gas Mains	203	-	74	277
474	Bio Gas House Regulators & Meter Installation	406	-	148	554
478	Bio Gas Meters	406	-	-	406
	Total Interconnection Facilities	1,015	-	222	1,237
	Total Bio Gas Plant Additions	$ 3,578	$ -	$ 222	$ 3,800
		A-3			
	Contributions in Aid of Construction - 2011				
	CIAC transferred from Lions Gate	$ 50			
	ICE & BCBN funding	516			
	Total Biomethane CIAC	$ 566			
		A-4			

(B) Restatement of Table J-1 Biomethane Capital Costs Summary

Particulars	Catalyst	CSRD	Total Additions
2010 / 2011 Current Projects Costs			
Upgrader	$ -	$ 1,934	$ 1,934
Interconnection (Valves, meter, Regulator	337	396	733
Quality Monitoring	164	253	417
Mains & Mains Connection Costs	86	34	120
Total Interconnection Facilities	588	683	1,270
Total Bio Gas Plant Additions excl. AFUDC & Overheads Capitalized	$ 588	$ 2,617	$ 3,204
			A-1
Future Projects Capital Costs		**2012**	**2013**
Upgrader		$ 2,063	$ 2,563
Structures & Improvements		140	140
Mains - Municipal Land		109	109
Mains - Private Land		61	61
Regulator & Meter Installations		16	16
Meters		25	25
Measuring & Regulating Equipment		663	663
Total Interconnection Facilities		1,015	1,015
Total Biogas Plant Additions excl. AFUDC & Overhead Capitalization		$ 3,078	$ 3,578
		A-2	A-3
Check Variance to Total GPIS Additions	A-1	A-2	A-3
	$ 3,204	$ 3,078	$ 3,578
Variance	$ 0	$ (1)	$ (1)
CIAC (ICE & BCBN funding) - 2011 [1]	$ (516)		

(C) Biomethane Capital Costs from Biomethane Application, June, 2010 - Appendix J-2 & J-3

Particulars	Additions	AFUDC	Total	Reference
Upgrader	$ 1,622	$ 20	$ 1,642	Appendix J-3, Schedule 1, sum of 2010/2011
Meter	473	2	475	Appendix J-2, Schedule 1, 2010
Measuring & Regulating	525	3	528	Appendix J-2, Schedule 1, 2010
Main	273	2	275	Appendix J-2, Schedule 1, 2010
Total Interconnection	1,270	8	1,278	Appendix J-2, Schedule 1, 2010
Total Bio Gas Plant Addition [2]	$ 2,892	$ 27	2,919	
	A-1			
	$ 3,204			
	$ (312) [2]			

Note 1: RRA Application J-2 shows incremental new contributions, $50,000 was previously received and transferred from the Lions Gate Project

Note 2: From the original Biomethane Application to the Biomethane report the cost of the Upgrader for Salmon Arm is expected to increase by $312,000, total interconnect facility cost is expected to remain unchanged.

Revenue Requirement Biomethane O&M

Particulars	Reference in RRA	2011 Deferred Costs	2012 O&M Expense	2013 O&M Expense
Bomethane Program Costs				
Energy Services & External Relations	Pg. 208 - 217			
Labour Costs		$ 125	$ 102	$ 104
Customer Education		400	300	306
Contact Centre	Pg 194, 195			
Computer Cost		-	10	-
Inbound Calls		36	6	7
Rate Changes		4	-	-
Application Support		166	-	-
Customer Services				
Internal Reporting Charges		3	-	-
Field Services / Asset Management	Pg. 161, 174, 175			
Materials & Supplies		49	22	90
Operations Support	Pg. 239			
Materials & Supplies		-	26	26
Total O&M All Customers		$ 783	$ 466	$ 533
O&M Charged to BVA Deferral Account [1]				
Asset Management				
Upgrader - Materials & Supplies		$ 70	$ 123	$ 237
Gas Supply				
Energy Peace Application Support		23	-	-
Energy Services & External Relations				
Enrollment Confirmations		3	5	5
Contact Centre				
Customer Drops / Finalizations		11	32	33
Reporting & Administration		5	-	-
Process for Updating Heat Zone in new CIS System		-	20	-
Revenue & Billing Cycle				
Credits to Customers for Heat Content Adjustments		54	-	-
Total O&M Charged to BVA Deferral Account		$ 166	$ 180	$ 275

Note 1: O&M cost is directly charged to the **BVA deferral account** and is not reflected in the O&M **Expense** of Section 5 of the Application.

Appendix Table J-2 Biomethane O&M Costs Summary / **2010 Biomethane Application Appendix G / J-1**

Particulars	2011 Deferred Costs	2012 O&M Expense	2013 O&M Expense	2010 Deferred Costs	2011 Deferred Costs	Total 2010 / 2011 Deferred Costs	2012 O&M Expense
Labour Costs	$ 125	$ 102	$ 104	$ 25	$ 100	$ 125	$ 100
Computer Costs	-	10	-	-	-	-	10
Customer Education	400	300	306	160	240	400	300
Internal Reporting Changes	3	-	-	1	2	3	-
Inbound Calls	36	6	7	7	29	36	6
Rate Changes	4	-	-	-	4	4	-
Application Support	166	-	-	166	-	166	-
Subtotal	734	418	417	359	375	734	416
Interconnect Facilities - Materials & Supplies	49	48	116	-	-	-	-
Total O&M All Customers	$ 783	$ 466	$ 533	$ 359	$ 375	$ 734	$ 416

For the Program O&M costs an additional $26 thousand has now been added in 2012 and 2013 for Operations Support work for the Biomethane Program in Interconnect Facilities - Materials & Supplies.

Particulars	2011 Deferred Costs	2012 O&M Expense	2013 O&M Expense	2010 Deferred Costs	2011 Deferred Costs	Total 2010 / 2011 Deferred Costs	2012 O&M Expense
O&M Charged to BVA Deferral Account							
Upgrader - Materials & Supplies	$ 70	$ 123	$ 237	$ 30	$ 89	$ 119	$ 91
Energy Peace Application Support	23	-	-	5	19	24	-
Enrollment Confirmations	3	5	5	1	2	3	37
Customer Drops / Finalizations	11	32	33	2	8	10	-
Credits to Customers for Heat Content Adjustments	54	-	-	6	48	54	-
Reporting & Administration	5	-	-	1	5	6	-
Process for Updating Heat Zone in new CIS System	-	20	-	-	-	-	20
Subtotal	96	57	38	15	82	97	57
Total O&M Charged to BVA Deferral Account	$ 166	$ 180	$ 275	$ 45	$ 171	$ 216	$ 148

For Appendix Table J-2 in the RRA a correction was made to the materials and supplies in which Interconnect Facilities O&M had been included with the Upgrader Materials and Supplies in 2010 Biomethane Application Appendix J-1. The amount of the correction in 2011 was $49,500

(A) Biomethane Program Costs Embedded in 2012 Rate Base Opening Adjustment

	2010	2011	
Non-Rate Base Deferral Account			
O&M Program Costs			
Program O&M Activity	$ 1	$ 783	
Application Costs		260	
Tax Rate	28.5%	26.5%	
Tax Offset	(0)	(276)	
AFUDC	0	39	
Total Additions	1	806	
Cumulative Balance	$ 1	$ 807	
Biomethane Program Costs - Other Revenue			
Depreciation on Interconnecting Facilities		$ 45	
Income Tax		9	
Earned Return		36	
Other Revenue		45	
Balance		$ 90	
Total Non-Rate Base Transferred to Rate Base at Beginning of 2012		$ 897	Section 7, Tab 7.1, Sched. 68, Line 13
Annual Amortization for 3 Years		$ 299	

Note: See also BCUC IR 1.181.2

(B) RRA - Appendix Table J-5 / **(C) 2010 Biomethane Application Appendix J-2**

	(B) 2010	(B) 2011	(C) 2010	(C) 2011	Reference
Non-Rate Base Deferral Account					
O&M Program Costs					
Program O&M Activity	$ 1	$ 783	$ 359	$ 375	Schedule 7
Tax Rate	28.5%	26.5%	28.5%	26.5%	
Tax Offset	(0)	(207)	(102)	(99)	Schedule 7
AFUDC	0	39	17	38	Schedule 7
Total Additions	1	615	274	314	
Cumulative Balance	$ 1	$ 615	$ 274	$ 587	Schedule 7
Biomethane Program Costs - Other Revenue					
Depreciation on Interconnecting Facilities		$ 45	$ 31	$ 61	Schedule 5, Line 19
Income Tax		9	1	12	Schedule 9, Line 19
Earned Return		36	23	96	Schedule 8, Line 24
Other Revenue		45	55	169	Schedule 10, Line 8
Balance		$ 90	$ 55	$ 224	Schedule 7, Line 17
Total Non-Rate Base		$ 705	$ 329	$ 811	Schedule 7, Line 31
Annual Amortization for 3 Years		$ 235		$ 270	Schedule 7, Line 36

Biomethane Variance Account	RRA - Appendix J, Table J-3 / 4 [1] 2010	2011	2012	2013	2010 Biomethane Application Appendix J-3 2010	2011	2012
Biomethane Purchases							
Actual Table J-3	$ 60	$ 92					
Projected / Forecast	-	513	$ 1,254	$ 1,425	$ 422	$ 1,154	$ 1,179
Total Biomethane Purchases	60	605	1,254	1,425	422	1,154	1,179
BVA O&M Activity	-	166	180	275	45	171	148
Property Taxes	-	1	2	1	1	1	5
Depreciation: Upgrader & CIAC	-	(9)	202	387	(13)	90	94
Income Tax	-	(126)	(246)	(373)	(98)	(95)	(30)
Earned Return	-	(0)	184	344	2	82	75
Other Revenue	-	(126)	(62)	(29)	(96)	(13)	45
BERC Rate Recoveries	-	(604)	(1,840)	(2,818)	(432)	(1,332)	(1,344)
Tax Rate	28.5%	26.5%	25.0%	25.0%	28.5%	26.5%	25.0%
Tax Offset	(17)	(44)	101	279	(10)	2	3
Net Additions	43	(12)	(163)	(480)	(83)	73	130
Cumulative Balance	$ 43	$ 31	$ (132)	$ (611)	$ (83)	$ (11)	$ 119

Note 1: See BCUC IR 1.186.5 re Depreciation & CIAC Amortization

Attachment 189.1

REFER TO LIVE SPREADSHEET MODELS
Provided in electronic format only

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(accessible by opening the Attachments Tab in Adobe)

Attachment 189.2

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Attachment 191.1

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Attachment 191.2

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Attachment 192.4.3

Northeast Energy Efficiency Partnerships

REGIONAL EM&V METHODS AND SAVINGS ASSUMPTIONS GUIDELINES

A Product of the Regional Evaluation, Measurement & Verification Forum

May 2010

Facilitated and Managed by Northeast Energy Efficiency Partnerships

Table of Contents

PREFACE

Regional EM&V Methods & Assumptions Guidelines

Background and Purpose: These Regional Evaluation, Measurement and Verification (EM&V) Methods & Assumptions Guidelines ('the Guidelines') were prepared for the Regional EM&V Forum ('the Forum'). The Forum, established in 2008, is a regional project facilitated and managed by Northeast Energy Efficiency Partnerships (NEEP) representing states in New England[1], New York, New Jersey, Maryland, Delaware, and the District of Columbia.

The intent of these guidelines is to provide clarity, transparency, and a common understanding of methods to consider in determining gross energy and demand savings, and savings assumptions for a priority set of energy efficiency program/project types or measures. The Forum initiated this project because it is believed that some form of EM&V guidance, if implemented and used, can provide the following benefits to the Region:

- Improve the credibility and comparability of energy efficiency resources to support state and regional energy, climate change and other environmental policy goals;
- Remove barriers to the participation of energy efficiency resources in regional markets by making EM&V practices and savings assumptions more transparent, understandable and accessible;
- Reduce the cost of EM&V activities by leveraging resources across the region for studies of common interest (where a need for new data has been identified); and
- Inform the potential development of national EM&V protocols.

Basis for Guidelines: The Guidelines are based on research that captures existing EM&V methods used in the industry today[2]. They are presented in the format of cross-cutting recommendations that are applicable to fourteen measures/programs (covering topics such as rigor, site inspections and measure life determination), and in the form of measure specific recommendations. The Guidelines recommend basic EM&V methods, and alternative or additional approaches for conducting EM&V which Forum participants can use independently for any one program/measure type, and/or in combination, depending on the specific energy efficiency project, program or portfolio objectives.

The Guidelines are also based on a review and comparison of savings input assumptions and algorithms for the set of measures/programs. The Guidelines recommend and provide commentary on: where greater consistency on certain savings assumptions makes sense; where consistency is neither appropriate nor warranted; and where better documentation (or

[1] Connecticut, Massachusetts, Maine, New Hampshire, Rhode Island, and Vermont.
[2] The Guidelines are based on the EM&V Forum project *Develop Common EM&V Methods and Savings Assumptions* conducted by KEMA Consulting, April 2010. To view full report, see http://neep.org/emv-forum/forum-products-and-guidelines.

new research) is needed to support savings assumptions, in particular those that are deemed or stipulated.

Use of Guidelines: The Guidelines are not intended to be mandatory, as it is recognized that identical EM&V requirements and practices may be difficult to implement for the entire Forum Region given states or jurisdictions can have different program and EM&V objectives, budgets, and uses for their EM&V analyses. As such, these guidelines attempt to capture an appropriate balance of being flexible and not overly prescriptive, while providing sufficient detail so as to be meaningful and useful so that the Region can move towards greater consistency in how energy efficiency savings are determined.

The Guidelines are intended only to guide the design of comprehensive studies that estimate multiple impact parameters for one of the fourteen measures addressed in this report – *once a determination has been made to conduct such a comprehensive study*. The Guidelines should not be interpreted as suggesting that such comprehensive studies are always desirable, should be conducted with any particular frequency or should be routinely integrated into annual savings verification procedures. Decisions on when such comprehensive studies should be conducted will necessarily be based on local factors, including local trade-offs between the benefits of additional accuracy of savings estimates and the cost of such studies.

The Guidelines are also not necessarily applicable to studies intended to focus only on individual parameters or subsets of parameters. Further, the Guidelines do not make recommendations regarding transferability of evaluated results from one service territory to another within a state or region. While use of secondary data is generally accepted within the Forum region as a means to reduce evaluation costs (including for certain Forum projects e.g., commercial lighting loadshape study), validity implications of data transferability have yet to be explicitly and consistently addressed. It is recommended that the Forum develop guidelines on the transferability of evaluation results and review evaluation cycles to help ensure that the results are valid, appropriate, and reasonable.

Evaluators, program administrators, policymakers and others are encouraged to refer and use these recommended Guidelines, along with other Forum products on common EM&V terminology and common reporting formats, and to make suggestions for improvements and/or changes going forward. These Guidelines, as such, are viewed as a living document, and may lead to future projects that expand the measures/programs covered beyond those included herein. Additional efforts may also include exploring how the Forum's efforts, with respect to consistency, can support or perhaps even lead to similar efforts in other regions and nationally as efficiency becomes an increasingly greater strategy in energy and climate change mitigation efforts.

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Regional EM&V Methods and Savings Assumptions Guidelines

These Guidelines identify and define common and consistent methods for preliminary (ex-ante) savings, gross and net evaluated (ex-post) savings, measure baseline, life, and persistence, and strategies for dealing with uncertainty/rigor. The Guidelines cover the following program and technology types (fourteen in total)

Program Types/Measures	
Residential	
Central A/C Comprehensive Multi-Measure (R)	Gas Boilers/Furnaces Lighting (Res)
Commercial/Industrial	
Comprehensive Multi-Measure (NC) Custom Measures (R/NC) Gas Boilers/Furnaces HVAC (NC/TR) Lighting (NC)	Lighting (R) Motors (NC/TR) Prescriptive Chillers (NC/TR) Unitary/Split HVAC (NC/TR) VSDs (R/NC)

The Guidelines address each of the following EM&V elements:

- Estimating initial/preliminary gross energy and demand savings;
- Calculating gross evaluated energy and demand savings;
- Determining baseline conditions; and
- Determining measure life and persistence.

The first two elements are discrete for each of the fourteen electric and gas efficiency measures herein. For the latter two areas, Cross-Cutting Guidelines are provided.

1.1 Cross-Cutting Guidelines

This section presents guidelines for specific aspects of evaluation, measurement and verification practice that apply across the measures and are equally appropriate for all current and future measures that may be added to these guidelines.

1.1.1 Installation Verification

Verification refers to a program implementation process by which in-house staff or contracted inspectors verify the installation of all or a sample of installed measures. For most measures, this "quality control" procedure is performed prior to issuance of an incentive payment. This sort of verification is impractical for some small prescriptive and self-install measures, e.g. residential retail CFLs. In the context of evaluation, verification is a method of assessing impacts without direct measurement, e.g. phone surveys, on-site inspections, etc. Only when paired with measurement does verification become "M&V."

Verification of a sample of installations is highly recommended for all programs and measure categories. Verification incurs a cost, but as system reliability becomes more closely linked to energy efficiency resource performance, this cost provides increasing benefits. Assuming that payment of an incentive or proof of purchase equates to energy savings becomes riskier as the margins for error decrease.

Verification is often limited to projects/measures with the greatest cost and savings. When much is at stake in large projects, it is easier to verify to also justify the cost. However, some measures, such as compact fluorescent lamps, in aggregate can have an equivalent impact if not installed.

Installations should be verified by either a third party or by program administration staff. We emphasize that sampling approaches and regularly scheduled verification studies may be appropriate for some measures/programs instead of continuous verification for the full population. Procedures should be implemented to ensure that differences noted in inspection get reflected in program tracking. A higher verification fraction is recommended in program infancy, very large installations, or following substantive program revisions.

1.1.2 Determining Baseline Conditions

Within each of the measure-specific guidelines below there is a definition for the measure's baseline efficiency, a critical input into the savings calculation. In its simplest formulation, the savings forecast is the difference between what is (the baseline) and what will be (the intended condition). From there it gets more complicated. The baseline for a specific measure is not a single number.

For most measures there will be at least two baselines, one for market-driven choices (often called "lost opportunity" and either replacing equipment that has failed or new installations) and one for discretionary installations (often called retrofit or early retirement). In the first case, the baseline may be a jurisdictional code, a national standard, or the prevailing level of efficiency in the marketplace. For retrofit installations, the efficiency of the existing equipment may be the baseline, but at some point the savings calculation must incorporate changes to the baseline for new installations, e.g. code or market changes. Even at this level of differentiation, the baseline may not be correct.

A prime example of this phenomenon occurs when code is used as a baseline. The assumption that a legal requirement translates into action is foresworn by the full gamut of human behavior, even when there is enforcement to encourage compliance, as with speed limits. In the realm of efficiency, where compliance mechanisms often lag regulation and the "behavior" is much more private, it is even riskier to assume that the law is being followed.

It is recommended that a regular review of baselines in use be undertaken to determine and prioritize baseline research on a three to five year cycle. This process is critical to achieving, and maintaining, alignment between the conditions as they are and the conditions as they are used in savings calculations.

1.1.3 Determining Measure Life and Persistence

The measure-specific guidelines can be used to determine the savings for a discrete period of time. The capacity savings (kW) are instantaneous and calculated with reference to the maximum load. The energy savings (kWh) are typically presented for the first year. However, most measures last for more than one year.

Comprehensive guidelines should define a process for determining measure life for each measure, and then memorializing both the process and the outcome in comprehensive resources. While any of the methods currently used, e.g. vendor estimates & stipulated value, may be accurate, without structured review and analysis they may misrepresent actual performance. As for baseline conditions above, there should be a regular review cycle to assure that each measure lifetime assumption is not so old as to be out of date. A full measure life study is not needed for each measure every three or five years. Rather, an intentional process to determine if a study is appropriate is recommended.

Temporal factors “persistence” and “in-service rate” are not uniformly used. Some use these factors, some report them as incorporated in the measure life, and in some cases it is not clear if they are addressed. Measure life should be defined to include these factors if they are deemed necessary by the Forum or by external stakeholders, and should be considered in the design of measure life research.

1.1.4 Statistical Precision

The matter of quantifying the statistical precision of a composite domain such as an energy-efficiency portfolio is a complex one, and analytical consultants can assist with this process. One of the practical implications is that the statistical precision for dominant measures/sectors can ‘carry’ one’s portfolio, i.e. ensure the portfolio achieves precision targets regardless of the precision in other program areas. In a strictly statistical sense, the level of precision for dominant program areas such as Large C&I Retrofit or Residential Lighting tends to be far more important than the precision of lesser areas such as HVAC tune-ups or ENERGY STAR Appliances. In fact, the statistical precision of ‘minor’ portfolio components can remain immaterial even with assumed ±100% precision.

Program administrators must also consider that statistical precision in impact evaluation is not solely a matter of regulatory and capacity market rules compliance. Statistical precision is an important means of expressing the validity of estimated tracking and evaluation impacts. Further, one must remember that statistical precision often positively correlates with evaluation cost. This is true because sample size increases with statistical precision, and for each sample point that improves statistical precision there is an added burden of evaluation cost (i.e. added travel costs, monitoring equipment, interviews etc.). Despite increased rigor from capacity market rules, sample designs must remain efficient and optimized to achieve appropriate precision at a reasonable cost.

Recommendations: In order to establish and achieve statistical precision objectives in all required/sought dimensions, the following process should be considered:

1. Identify statistical confidence/precision requirements. These should include key requirements (e.g. capacity market specifications) and legacy objectives (e.g. 90/10 for annual energy savings). Also, establish the domain for each requirement, be it the portfolio, program, state, load-zone, etc.
2. Establish your unique precision targets and dimensions. Regulatory and market requirements may offer program administrators either a threshold or a range of confidence intervals and precision. In either case, program administrators may make an independent assessment of the precision targets that are necessary for their particular needs relative to the domain of the evaluation (i.e. sector, program, end use), their intended use and audience for the evaluation results, and considerations of expected variability and the financial or system impact of varying degrees of uncertainty.
3. Pursue the most challenging target. In most cases, statistical objectives will be multi-pronged, e.g. 80/10 for summer kW, 80/10 for winter kW, and 90/10 for energy kWh. Designing a single sample to meet all objectives can be difficult and is dependent upon the unique population characteristics and expected variability for each parameter. In practice, one often can achieve all objectives by pursuing the element with the greatest variability; for New England large C&I programs, this tends to be the winter coincident demand impact. For example, a recent KEMA large C&I impact evaluation achieved ±10.6% precision for winter kW and ±8.2% precision for summer kW (both at 80% confidence as per ISO New England requirements) and ±4.7% precision at the 90% confidence level.

It is important to note that these confidence/precision requirements are for statistical sampling alone and do not reflect other sources of uncertainty such as measurement error, equipment accuracy, and parameter bias. Most M&V manuals (ISO New England, PJM Interconnection, Federal Energy Management Program (FEMP), American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE)) include guidelines for controlling these other sources of error.

1.1.5 Other Sources of Uncertainty and Threats to Validity

Statistical precision gets a lot of attention in efficiency program evaluation. Most evaluators are familiar with error bounds, confidence intervals, and relative precision, the most commonly used techniques for reporting statistical precision. However, many do not realize that statistical precision can be misleading if there is bias or non-statistical error in the underlying data. Bias can be hard to identify and extremely difficult to quantify, but it ought not be ignored or dismissed. One must remain vigilant for sources of error such as response bias, hand-picked (or excluded) sample projects, and measurement error. The California Evaluation Framework offers some good advice on mitigating bias and strengthening validity:

"In a high quality evaluation, those implementing the study would strive to mitigate the risk of bias and to honestly report any circumstances about the study that might increase the likelihood of bias. Unfortunately, it usually takes extra time and money to reduce the risk of bias, and the usual measures of the statistical precision of the results may not be improved at all. For example, in order to reduce the risk of non-response bias in a telephone survey, a substantial investment may be needed in more extensive training for the surveyors, more call backs, and perhaps to offer a financial incentive to each respondent. It may be tempting to accept a higher non-response rate and divert these resources to a larger sample size since this strategy will almost certainly give a narrower confidence interval. This strategy can seriously compromise the integrity of a study. To make appropriate judgments in planning and executing sound evaluation studies and in interpreting their results, evaluators, reviewers, and those using evaluation results need to understand what bias is, how it can arise, and how it can undermine an evaluation study."[3]

In sections on Statistical Significance, both the ISO New England and PJM Interconnection M&V manuals require Project Sponsors to describe methods for mitigating and controlling bias in demand estimates. These manuals list many sources of potential bias beyond statistical precision. According to these manuals, relevant types of potential bias for estimates based upon engineering and direct measurement include but are not limited to:

- accuracy and calibration of the measurement tools;
- measurement error;
- engineering model bias;
- modeler bias;
- deemed parameter bias;
- meter bias;
- sensor placement bias; and
- sample selection bias or non-random selection of equipment and/or circuits to monitor.

For estimates based upon regression or statistical analysis, relevant types of potential bias include but are not limited to:

- model misspecification;
- statistical validity;
- error in measuring variables;
- autocorrelation;
- heteroscedasticity;

[3] *The California Evaluation Framework*, Chapter 12: Uncertainty, January 2006, p. 290.

- collinearity;
- outlier data points; and
- missing data.

For estimates based upon survey or interview data, relevant types of potential bias include but are not limited to:

- construct validity;
- sampling frame versus population;
- selection bias (for a sample and for a census attempt where not all sites within the census received usable data);
- non-response bias;
- error in measuring variables;
- sample homogeneity relative to project (external validity);
- outlier data points; and
- missing data.

Beyond a few vocal experts and advocates, the evaluation community is only beginning to grasp the importance and implications of these sources of uncertainty. The Forum is calling for a more balanced treatment of the true sources of uncertainty bearing on evaluation results, and this brief overview draws attention to the vast number of threats to validity beyond statistical precision.

1.2 Measure-Specific Guidelines

This section presents guidelines for fourteen measures or program types. The measure specific recommendations use a concise, two-section format to present guidelines on the following issues:

- Estimation methods and savings assumptions for initial/preliminary gross energy and demand; and
- Recommended M&V methods for pursuing gross evaluated energy and demand.

The first piece of each guideline presents the prevailing savings algorithm with a listing of inputs and savings assumptions. The second piece of each guideline is a brief outline of recommendations pertaining to program tracking and recommended/alternative M&V methods. Tracking recommendations relate to the data management processes and systems employed to document and database the savings associated with energy efficiency program measure installations. These recommendations emphasize completeness of pre-evaluation "initial gross" and "net" estimates of energy and demand impacts. *The recommended and alternative M&V methods correspond to the "Options" defined in either the ISO New England or PJM Interconnection M&V manuals.* These regional capacity market M&V

requirements are the prevailing compliance concern in the Forum region, and are largely based on the International Performance Measurement and Verification Protocol (IPMVP).

Finally, while the following guidelines focus upon primary M&V research, the readers should be aware of a recent EM&V Forum effort[4] that investigated the usability and transferability of load shape data from other sources, i.e. secondary data. Many jurisdictions have expressed support for the use of secondary data for measures such as residential lighting. This is an emerging issue, and guidelines for applicability of evaluation results and/or demand savings have yet to be fully explored in the Northeast.

[4] End-Use Load Data Update Project Final Report, Phase1: Cataloguing Available End-Use and Efficiency Measure Load Data, September 2009. Available at http://neep.org/emv-forum/forum-products-and-guidelines.

1.2.1 Residential Central Air Conditioning

RESIDENTIAL CENTRAL AIR CONDITIONING

Savings Assumptions for Initial Gross Energy and Demand

Prevailing Algorithm for Energy and Demand:

kWh Saved = (Size in Btu/hr) x (1/$SEER_{baseline}$ - 1/$SEER_{installed}$) / 1000 x (Full Load Cooling Hours)
kW Saved = (Size in Btu/hr) x (1/$EER_{baseline}$ - 1/$EER_{installed}$) / 1000 x (Coincidence Factor)

Notes on Algorithm:

1. Some entities express unit size or cooling capacity in terms of "tons" of cooling, a unit of power equivalent to 12,000 Btu/hr but lacking accuracy due to nominal tonnage nomenclature.
2. Other algorithms use discrete estimates of load factor, diversity factor, and coincidence factor in place of a combined "coincidence" factor to account for all these effects. The product of the three discrete factors is equivalent to the single combined loading/diversity/coincidence factor.
3. Most Technical Reference Manuals (TRMs) cite "full load hours" or "equivalent full load hours" in their algorithm, but one TRM uses "cooling load hours" which separates the influence of electrical efficiency from the time term in the equation.

Description of Inputs:

Baseline Efficiency: Rated Seasonal Energy Efficiency Ratio (SEER) and Energy Efficiency Ratio (EER) of baseline equipment as per established standard or baseline study. Approximately 13 SEER and 11 EER. "Early retirement" tracks either prorate the existing and new construction baselines over the measure life or assume 9 or 10 SEER for baseline.

Installed Efficiency: Rated SEER and EER of installed equipment as per Air-Conditioning, Heating, and Refrigeration Institute database. Approximately 14 SEER and 12 EER or refer to "Energy Star or higher".

Units of Cooling Capacity: Engineering units for cooling capacity in Btu/hr for accuracy and to ensure efficiency compliance.

Full Load Cooling Hours: The ratio of annual cooling unit energy to nameplate peak demand. Cooling hours should reflect localized climate conditions and be based upon technical research studies. With few exceptions, most states in the Forum region have distinct climate zones which warrant distinct estimates of cooling hours.

Demand Factors: Adjustments to rated demand for use in deriving coincident impacts; recommendation is to consolidate these discrete adjustments into one coincidence factor for each season, i.e. Summer and Winter. As with full load cooling hours, seasonal coincidence should reflect localized climate conditions and should be based upon technical research studies.

- **Loading**: The ratio of peak observed to rated maximum load for a piece of equipment. A discrete factor to express equipment over sizing effects at the typical unit level.
- **Diversity**: The ratio of the maximum combined demand to the sum of non-coincident demands across a group. A discrete factor which expresses the extent to which a group contributes to a combined maximum.
- **Summer Coincidence**: The ratio of peak demand at the same time as a "summer" period to the peak demand across all periods. Summer coincidence factors range from 70% to 100% across the regional TRMs.
- **Winter Coincidence**: The ratio of peak demand at the same time as a "winter" period to the peak demand across all periods. The winter coincidence factor should be 0% for residential central air conditioning.

Opportunities for Improved Consistency or Areas Where Differences are Warranted:

1. Standardize on Btu/hr as the unit of cooling capacity in the interest of accuracy and compliance.
2. Include both SEER and EER in algorithms for the best expression of both seasonal and peak performance.
3. Consolidate load, diversity, and coincidence factors into single factor combining all peak coincidence drivers.
4. Document credible sources for all savings assumptions. Currently, not all savings assumptions are clearly documented, and TRMs ought to cite credible sources for all savings assumptions to improve methodological transparency.
5. Develop (or continue to use) localized assumptions for cooling hours and peak coincidence. Consistent assumptions used for cooling hours across some states may not be warranted due to climate zones.
6. Consider differentiating by home vintage and location in program estimates of full load cooling hours.

RESIDENTIAL CENTRAL AIR CONDITIONING
Summary of Recommended EM&V Methods

This category is limited to central air conditioning (CAC) installed as a stand-alone measure and excludes CAC installed through comprehensive new construction programs. This category does not include ENERGY STAR room air conditioners or "space cooling" measures.

Aspect	Detailed Approach	Comments
Program Tracking	At a minimum: initial gross energy and demand savings, as well as initial net impacts as applicable. Additional: number of installed units, unit capacity, baseline and installed efficiency, and full load cooling hours.	Additional parameters useful for quality control and also for evaluation design, e.g. sampling.
Recommended M&V Method	On-site inspections with partial measurements on a sample of program participants (Option A). Site visits with short-term metering can offer the most defensible approach to residential CAC programs.	Metering methods often include time-of-use loggers and spot power measurements.
Alternative M&V Methods	An enhanced alternative to the above would be on-site inspections with metering that fully isolates the entire CAC system (Option B).	Metering would be interval kW measurements on both the outdoor compressor and indoor fan units.
	Billing analysis (Option C) can be a reasonable energy evaluation method for residential CAC at lower cost. Central AC tends to be rather evident in whole-premise metering, although other substantial electric loads can be an obstacle.	Billing analysis alone cannot quantify demand impacts.
	Calibrated simulation modeling (Option D) is a high rigor alternative which is especially effective at capturing measure interaction. While perhaps excessive for stand-alone CAC, simulation modeling is particularly appropriate for evaluating comprehensive cooling measures.	Metering would mirror Option B probably with whole premise interval kW and some temperature measurements.

1.2.2 Residential Comprehensive Multi-Measure Retrofit

RESIDENTIAL COMPREHENSIVE MULTI-MEASURE RETROFIT
Savings Assumptions for Initial Gross Energy and Demand

Prevailing Algorithm for Energy and Demand:
No prevailing algorithm. These comprehensive retrofits are comprised of a wide variety of measures and technologies. Savings methods for the component measures are not well documented in TRMs.

Notes on Algorithm:
1. The various energy-efficiency vendors that deliver residential comprehensive multi-measure retrofit measures tend to employ in-house software for developing/reporting savings. While the vendors and software methods are approved by the program, the savings methods are not necessarily unified or consistent.
2. A detailed review of the algorithms and savings assumptions for the remaining component measures such as appliances, insulation, weatherization, and water heating necessitates an examination of each vendor's methods. Research is warranted in this area to promote methodological consistency.
3. Technical reference manuals tend not to document residential comprehensive multi-measure retrofits as an umbrella offering and do not provide sufficient data to facilitate a comparison of savings assumptions.

Description of Inputs:
Not available.

Opportunities for Improved Consistency or Areas Where Differences are Warranted:
1. Some of the simpler, component measures within residential comprehensive retrofit programs – such as domestic hot water - lend themselves well to a stipulated savings approach.
2. For lighting measures, a calculated approach using stipulated parameters, e.g. wattage reduction and hours-of-use, offers consistency for connected demand impact and localized tuning for energy and coincident peak demand savings.
3. Administrators should require transparency and consistent savings methodologies across all vendors delivering residential comprehensive retrofits in a given program or state.
4. Given the differences in climate and demographics across the Forum region, it is appropriate for program administrators to continue to develop certain localized assumptions that reflect local characteristics such as lighting hours-of-use, coincidence factors, and market standard insulation levels.

RESIDENTIAL COMPREHENSIVE MULTI-MEASURE RETROFIT

Summary of Recommended EM&V Methods

This category encompasses comprehensive multi-measure retrofit installations in residential homes. Sometimes called "deep retrofits" or "home energy services", these measures are characterized by a whole-home approach which typically involves an audit followed by efficiency recommendations for multiple end uses and technologies. The comprehensive residential approach tends to be electric-centric but also may span fuel measures such as water heating, boilers, or furnaces.

Aspect	Detailed Approach	Comments
Program Tracking	At a minimum: initial gross energy and demand savings, as well as initial net impacts as applicable. Additional: detail on individual measures, such as: air conditioner, heat pump, boiler/furnace, water heater quantities and sizes; baseline and installed equipment efficiencies; home square footage; insulation and weatherization actions.	Additional parameters useful for quality control and also for evaluation design, e.g. sampling.
Recommended M&V Method	On-site inspections with partial measurements on a sample of program participants (Option A). Site visits with visual inspections, quality of installation assessments, interviews, and short-term metering for select measures. Simple engineering models of savings impacts.	Metering limited to time-of-use loggers on lighting and HVAC equipment supported by spot power measurements.
Alternative M&V Methods	A dual-fuel option is to pair the Option A approach with a billing analysis (Option C) of gas impacts. Diagnostic testing of HVAC equipment, blower door, and duct blaster tests can add rigor and certainty to savings for envelope measures.	Billing analysis alone cannot quantify demand impacts.
	Calibrated simulation modeling (Option D) is a high rigor alternative which is especially effective at capturing measure interaction. Particularly appropriate for comprehensive multi-measures.	Metering would pursue HVAC system and whole premise interval kW and possibly some temperature measurements.

1.2.3 Residential Natural Gas Boilers and Furnaces

RESIDENTIAL NATURAL GAS BOILERS AND FURNACES

Savings Assumptions for Initial Gross Energy and Demand

Prevailing Algorithm for Energy and Demand:

Therms saved = (Size in Btu/hr INPUT) x (1/$AFUE_{baseline}$ - 1/$AFUE_{installed}$) x (Full Load Heating Hours) / 100,000

Alternative Algorithm:

Therms savings = (Size in Btu/hr INPUT) x EFLHeff x (AFUEeff/AFUEbase - 1)/100,000
Where the size of the unit and EFLHeff is for the installed high efficiency unit

Notes on Algorithm:

1. Most Technical Reference Manuals (TRMs) cite "full load hours" or "equivalent full load hours" (EFLH) in their algorithm, but one TRM uses "heating load hours" which separates the influence of thermal efficiency from the time term in the equation.
2. One TRM adds a heating load factor to explicitly adjust for over-sizing of the heating unit.
3. One state's algorithm accounts for the size of the installed and baseline units separately, using a fixed baseline capacity of 91,000 Btu/hr to represent the "typical heating unit" based on a baseline study.

Description of Inputs:

Baseline Efficiency: Rated Annual Fuel Utilization Efficiency (AFUE) of baseline equipment as per established standard or baseline study. Efficiency depends upon program type (early replacement, time of replacement, or new construction) as well as equipment type. Prevailing AFUE baselines are 75% for steam boilers, 78%-80% for furnaces, and 80-83% for hot water boilers.

Installed Efficiency: Rated AFUE of installed equipment as per Air-Conditioning, Heating and Refrigeration Institute (AHRI) database. Approximately 82% for steam boilers, 85% for non-condensing hot water boilers, 90% for condensing hot water boilers, and 92% for furnaces or refer to "Energy Star or higher".

Operating Hours: The ratio of annual heating unit energy to nameplate peak demand. Heating hours should reflect localized climate conditions and be based upon technical research studies. With few exceptions, most states in the Forum region have distinct climate zones which warrant distinct estimates of heating hours.

Summer Coincidence Factor: The ratio of peak demand at the same time as a "summer" period to the peak demand across all periods. The summer coincidence factor should be 0% for residential heating equipment.

Winter Coincidence Factor: The ratio of peak demand at the same time as a "winter" period to the peak demand across all periods. Currently, most regional TRMs do not specify coincidence factors for natural gas measures. Coincidence should reflect localized climate conditions and should be based upon technical research studies.

Opportunities for Improved Consistency or Areas Where Differences are Warranted:

1. Programs should take credit for electric impacts associated with efficient furnace fans within the natural gas furnace measure.
2. States currently using a custom approach for "point of sale" residential gas furnace and boiler measures should consider a prescriptive approach using the prevailing savings algorithm described above.
3. Develop (or continue to use) localized assumptions for heating hours and peak coincidence. Consistent assumptions used for heating hours across some states may not be warranted due to climate zones.
4. Consider differentiating by home vintage and location in program estimates of heating hours.

RESIDENTIAL NATURAL GAS BOILERS AND FURNACES

Summary of Recommended EM&V Methods

This category is limited to residential natural gas boilers and furnaces and excludes: space heating equipment such as portable or room space heaters; electric or oil space heating equipment; and associated controls such as boiler reset controls. This category addresses stand-alone heating equipment and excludes natural gas boilers/furnaces installed through comprehensive new construction programs.

Aspect	Detailed Approach	Comments
Program Tracking	At a minimum: initial gross energy and demand savings, as well as initial net impacts as applicable. Additional: number of installed units, unit capacity, baseline and installed efficiency, and full load heating hours.	Additional parameters useful for quality control and also for evaluation design, e.g. sampling.
Recommended M&V Method	Billing analysis (Option C) supported by telephone surveys or on-site inspections. Telephone surveys can be used to confirm installation and gather data on household demographics and other operational characteristics to support the billing analysis.	Billing analysis is only valid when the pre-existing (electric bills from the pre-retrofit period) is the appropriate baseline to be used in the impact analysis.
Alternative M&V Methods	Adding on-site inspections to the basic method above improves confidence in household characteristics and supports collection of equipment nameplate data. Basic short-term measurements (Option A) can be added on electrical support equipment such as furnace fans and boiler pumps to refine savings estimates.	Metering methods would include time-of-use CT loggers and spot power measurements.
	Calibrated simulation modeling (Option D) is a high rigor alternative which is probably excessive for stand-alone gas heating but would be appropriate for evaluating measures in a comprehensive package.	Natural gas sub-meters can be installed to isolate the heating equipment from other end uses.

1.2.4 Residential Lighting

RESIDENTIAL LIGHTING

Savings Assumptions for Initial Gross Energy and Demand

Prevailing Algorithm for Energy and Demand:

kWh Saved = $(\text{Quantity}_{\text{baseline}} \times \text{Watts}_{\text{baseline}}) - (\text{Quantity}_{\text{installed}} \times \text{Watts}_{\text{installed}})$ / 1000 × (Annual Hours)

kW Saved = $(\text{Quantity}_{\text{baseline}} \times \text{Watts}_{\text{baseline}}) - (\text{Quantity}_{\text{installed}} \times \text{Watts}_{\text{installed}})$ / 1000 x (Coincidence Factor)

Notes on Algorithm:

1. Some Technical Reference Manuals (TRMs) stipulate the wattage reduction, utilizing a common Quantity term and substituting a ▫Watts or kW/unit term for $(\text{Watts}_{\text{baseline}} - \text{Watts}_{\text{installed}})$ in the equation above.
2. For retail programs, an in-service rate (ISR) often is added to the gross savings algorithm to represent the percentage of rebated units that actually get used. Some entities presume 100% installation rate or account for ISR in a net savings adjustment.

Description of Inputs:

Baseline Fixture Quantity: The number of fixtures in the corresponding baseline. The same as **Installed Fixture Quantity** for one-to-one replacements.

Baseline Fixture Wattage: For CFLs, baseline is typically 3.4 times **Installed Fixture Wattage**. For other fixture/lamp types, baseline wattage obtained from lookup tables developed and refined by technical and baseline studies.

Installed Fixture Quantity: The number of installed fixtures.

Installed Fixture Wattage: The rated wattage of the installed fixture, inclusive of both lamp and ballast. Obtained from nameplate data.

Annual Hours: The number of operating hours for the fixture in a typical year. Depending upon the program delivery vehicle, this can be derived from site-specific information, research-based estimates of lighting hours by room type, or – for retail programs – assigned a typical whole-home estimate which reflects the uncertainty of the lamp location. Residential lighting lends itself well to shared hours-of-use studies.

Coincidence Factors: Adjustments to rated demand for use in deriving coincident impacts; recommendation is to consolidate the Diversity into the Summer and Winter coincidence factors.

Diversity: The ratio of the maximum combined demand to the sum of non-coincident demands across a group. A discrete factor which expresses the extent to which a group contributes to a combined maximum.

Summer Coincidence: The ratio of peak demand at the same time as a "summer" period to the peak demand across all periods. Summer coincidence factors range from 9% to 35% across the regional TRMs.

Winter Coincidence: The ratio of peak demand at the same time as a "winter" period to the peak demand across all periods. Winter coincidence factors range from 5% to 100% across the regional TRMs.

Opportunities for Improved Consistency or Areas Where Differences are Warranted:

1. A calculated savings methodology would facilitate regional consistency better than stipulated savings. Demand reductions by lighting technology are logical stipulations as inputs, and a consistent algorithm would allow for localized tuning of hours and coincidence for savings impacts.
2. Direct install residential lighting programs in the region assign lighting hours by both room type and fixture type. Improved consistency would come from agreeing on one hours-of-use dimension – either room type or fixture type.
3. The majority of residential lighting programs factor the ISR into gross savings, while a few reflect this adjustment in net savings. Achieving regional consistency suggests inclusion of ISR as a gross effect.
4. Combine coincidence factor with diversity. This should help to address significant differences observed in winter coincidence factors.
5. Given demographic, geographic, program maturity, and behavioral differences in lighting usage across region, specific states/utilities should consider localized assumptions for lighting hours, peak coincidence, and HVAC interactive factors.

RESIDENTIAL LIGHTING
Summary of Recommended EM&V Methods

This category is limited to single-family residential lighting exclusive of specialty low-income and multi-family programs. These measures span new construction, retrofit, direct install, and retail lighting programs.

Aspect	Detailed Approach	Comments
Program Tracking	At a minimum: initial gross energy and demand savings, as well as initial net impacts as applicable. Additional: baseline quantity and wattage, installed quantity and wattage, location (as available), hours of use, in-service rate, HVAC interaction.	Additional parameters useful for quality control and also for evaluation design, e.g. sampling.
Recommended M&V Method	On-site inspections with partial measurements on a sample of program participants (Option A). Complete “socket counts” by room and fixture type provide key data for impact evaluations, baseline studies, and hours-of-use studies. Questions on purchasing habits and “shelf” stock inform in-service rate research. Site visits with time-of-use lighting loggers are the most defensible approach to residential lighting programs.	Time-of-use lighting loggers on a sample of lamps and fixtures, typically by room type.
Alternative M&V Methods	An alternative method is to rely upon telephone surveys to obtain information such as socket counts, hours of use, and purchasing habits. Research has shows that verbal hours tend to be overstated, but this type of Verification (not true M&V) is considered reasonable rigor for certain applications.	Not literally M&V without measurement, but this may comply with ISO-NE/PJM “Option A” with well-documented stipulations.

1.2.5 C&I Comprehensive Multi-Measure New Construction

C&I COMPREHENSIVE MULTI-MEASURE NEW CONSTRUCTION
Savings Assumptions for Initial Gross Energy and Demand

Prevailing Algorithm for Energy and Demand:

Technical reference manuals (TRMs) do not provide calculations or algorithms for commercial and industrial comprehensive multi-measures; each project is unique. Comprehensive projects are often directed towards large facilities and cover wide ranges of equipment, schedules, approaches, and measure interactions.

Notes on Algorithm:

1. Comprehensive multi-measures are akin to multiple, interactive custom measures, and custom measures do not have prevailing algorithms. Nonetheless, the fundamental approach is to characterize the full dynamics of energy usage for the baseline and installed conditions across all hours of the year.
2. Hourly building simulations are a popular method, however advanced 8,760 spreadsheets can model energy usage in a more transparent manner.
3. With regard to measure interaction, the sequence in which the multiple measures are assessed affects the total savings for the combined measures.

Description of Inputs:

Not applicable.

Opportunities for Improved Consistency or Areas Where Differences are Warranted:

1. It is not possible to anticipate all possible factors and assumptions that comprise comprehensive multiple measures. However, criteria when comprehensive measures are required should be established and stated clearly in technical program documentation.
2. Calculations using site-specific baselines, installed equipment, and savings assumptions provide the most appropriate and rigorous path to savings impacts. Establishing interactive requirements for custom multiple measures is essential in obtaining true energy and demand savings.
3. Comprehensive projects can be comprised of both custom and prescriptive measures, and interaction should be handled in such a way to avoid double counting. Interactive hierarchies should be developed to provide a uniform track to calculate and report savings.
4. Comprehensive measures are inherently unique and project-specific. Even if methodological consistency is pursued (e.g. using eQUEST models), each project should employ local weather and operational characteristics.

C&I COMPREHENSIVE MULTI-MEASURE NEW CONSTRUCTION
Summary of Recommended EM&V Methods

This category is limited to the installation of commercial and industrial comprehensive multi-measure new construction projects. The comprehensive and multi-measure category is not clearly defined or specifically mentioned in many of the TRMs. References to multiple measures are included in custom measure discussions.

Aspect	Detailed Approach	Comments
Program Tracking	At a minimum: initial gross energy and demand savings, as well as initial net impacts as applicable. Additional: savings by measure component; description of individual measures with, as applicable, unit quantities, sizes/capacities, baseline and installed efficiencies, and operating hours.	Additional parameters useful for quality control and also for evaluation design, e.g. sampling.
Recommended M&V Method	Calibrated simulation modeling (Option D) which is especially effective at capturing measure interaction. On-site data collection would gather parameters, specifications, and operational characteristics to inform the model.	Metering would include whole premise interval kW and some end use metering.
Alternative M&V Methods	A viable alternative would be on-site inspections with metering that encompasses the entire set of measures (Option B). A complex engineering spreadsheet model would capture the dynamics and interactions on an hourly basis. Less rigorous metering (Option A) could be performed if accuracy and validity is not a significant concern.	Metering would be interval kW measurements on all or select end use equipment.

1.2.6 C&I Custom Measures

C&I CUSTOM MEASURES

Savings Assumptions for Initial Gross Energy and Demand

Prevailing Algorithm for Energy and Demand:

Technical reference manuals (TRMs) do not provide calculations or algorithms for custom calculations since the category covers a wide range of equipment, approaches, and measures. Where custom measures are discussed, the TRMs require site specific equipment, operating schedules, baseline and installed efficiencies, and calculation methodologies in the development of energy and demand savings.

Notes on Algorithm:

1. Custom measures are non-standard which do not 'fit' prescriptive savings methods and assumptions.
2. While custom measures do not have prevailing algorithms, the fundamental approach is to characterize the full dynamics of energy usage across all hours and temperature conditions of a typical year.
3. Sometimes building simulations or vendor software are used to assess savings for custom measures. Advanced 8,760 spreadsheets can model energy usage in a more transparent manner than software.

Description of Inputs:

Not applicable.

Opportunities for Improved Consistency or Areas Where Differences are Warranted:

1. The custom approach is indispensable for delivering energy efficiency to customers, markets, or building/process systems that are not conducive to a standardized, prescriptive approach. However, custom measures are more costly and require technical in-house resources to examine and qualify non-prescriptive applications. Where program funding and technical resources permit, include a custom measure offering to capture more complex efficiency opportunities.
2. It is not possible to anticipate all possible factors and assumptions that comprise custom measures, so the scope of custom TRM entries should be limited. Custom calculations using site-specific baselines, installed equipment, and savings assumptions provide the most appropriate and rigorous path to savings impacts. Accordingly, there are no specific recommendations for the standardization of custom measure algorithms or approach.
3. Custom measures are inherently project-specific. Even if methodological consistency is pursued (e.g. standardized calculation models), the savings assumptions should employ localized weather and operational characteristics.

C&I CUSTOM MEASURES
Summary of Recommended EM&V Methods

This category is limited to the installation of commercial and industrial custom measures in both retrofit and new construction situations. The custom category includes measures that either do not comply with or benefit from examination beyond a prescriptive calculation approach. In general, these are more complex measures that necessitate site-specific information and detailed calculations to estimate energy and demand savings. In this context, custom measures may entail any end use or technology.

Aspect	Detailed Approach	Comments
Program Tracking	At a minimum: initial gross energy and demand savings, as well as initial net impacts as applicable. Additional: measure description with, as applicable, unit quantities, sizes/capacities, baseline and installed efficiencies, and operating hours.	Additional parameters useful for quality control and also for evaluation design, e.g. sampling.
Recommended M&V Method	On-site inspections with partial (Option A) or complete (Option B) measurements on a sample of program participants. Site visits with short-term metering represent the most defensible approach to C&I Custom measures. A complex engineering spreadsheet model would capture the dynamics and interactions on an hourly basis.	Metering methods often include time-of-use loggers, interval kW recorders, and spot power measurements.
Alternative M&V Method	If the Custom measure involves significant HVAC equipment and/or controls, calibrated simulation modeling (Option D) offers a high rigor alternative which is especially effective at capturing measure dynamics and interaction.	Metering would include whole premise interval kW and some end use metering.

1.2.7 C&I Natural Gas Boilers and Furnaces

C&I NATURAL GAS BOILERS AND FURNACES

Savings Assumptions for Initial Gross Energy and Demand

Prevailing Algorithm for Energy and Demand:

Furnaces < 225 MBH and boilers < 300 MBH

Therms saved = (Size in Btu/hr INPUT) x (1/$AFUE_{baseline}$ – 1/$AFUE_{installed}$) x (Full Load Heating Hours) / 100,000

Furnaces ≥ 225 MBH and boilers ≥ 300 MBH

Therms saved = (Size in Btu/hr INPUT) x (1/$Efficiency_{baseline}$ – 1/$Efficiency_{installed}$) x (Full Load Heating Hours)/100,000

Alternative Algorithm

Therms savings = (Size in Btu/hr INPUT) x EFLHeff x (AFUEeff/AFUEbase - 1)/100,000

Where the size of the unit and EFLHeff is for the installed high efficiency unit

Notes on Algorithm:

1. The prevailing algorithm only employs Annual Fuel Utilization Efficiency (AFUE), however the Air-Conditioning, Heating and Refrigeration Institute (AHRI) limits the use of AFUE to furnaces under 225 MBH and boilers less than 300 MBH. Units above this size have efficiency ratings in thermal efficiency and combustion efficiency. Accordingly, the recommended algorithm above includes a distinct expression for units above this size threshold.
2. Most Technical Reference Manuals (TRMs) cite “full load hours” or “equivalent full load hours” (EFLH) in their algorithm, but one TRM uses “heating load hours” which separates the influence of thermal efficiency from the time term in the equation.

Description of Inputs:

Baseline Efficiency: Rated AFUE or thermal efficiency of baseline equipment as per established standard or baseline study. Prevailing AFUE baselines are 75% for steam boilers, 78% for furnaces, and 80 for hot water boilers.

Installed Efficiency: Rated AFUE of installed equipment as per AHRI database. Approximately 82% for steam boilers, 85% for non-condensing hot water boilers, 90% for condensing hot water boilers, and 92% for furnaces.

Operating Hours: The ratio of annual heating unit energy to nameplate peak demand. Heating hours should reflect localized climate conditions and be based upon technical research studies. With few exceptions, most states in the Forum region have distinct climate zones which warrant distinct estimates of heating hours.

Summer Coincidence Factor: The ratio of peak demand at the same time as a “summer” period to the peak demand across all periods. Most programs do not estimate peak coincidence for gas measures; however one TRM specifies a 12% summer coincidence factor for commercial gas heating equipment.

Winter Coincidence Factor: The ratio of peak demand at the same time as a “winter” period to the peak demand across all periods. Most programs do not estimate peak coincidence for gas measures; however one TRM specifies an 88% winter coincidence factor for commercial gas heating equipment. Coincidence should reflect localized climate conditions and should be based upon technical research studies.

Opportunities for Improved Consistency or Areas Where Differences are Warranted:

1. While there is reasonable consensus on savings calculation methodologies and assumptions for small commercial natural gas heating equipment, it may be appropriate to treat large commercial boilers as custom measures. States currently using or considering a custom approach for small commercial gas heating equipment might consider a prescriptive approach under a given size threshold.
2. Differing limits placed on eligible capacities throughout the region may pose a barrier to greater consistency for commercial natural gas boiler and furnace measures. In two states, boiler capacity is used to determine whether a measure is treated as a custom measure, so capacity limits also impact how savings are calculated.
3. Given the differences in climate across the Forum region, it is appropriate for specific states or utilities to continue to develop localized assumptions for heating hours due to local characteristics of climate, demographics, and behavior.
4. Different types of commercial buildings may also have different operating patterns, and thus different heating hours. When shown to be relevant, savings parameters by location, vintage, or other dimensions should be employed.

C&I NATURAL GAS BOILERS AND FURNACES
Summary of Recommended EM&V Methods

This category is limited to commercial natural gas boilers and furnaces. Accordingly, the research did not include other types of space heating equipment, such as individual or room space heaters, electric or oil space heating equipment, or associated controls such as boiler reset controls.

Aspect	Detailed Approach	Comments
Program Tracking	At a minimum: initial gross energy and demand savings, as well as initial net impacts as applicable. Additional: number of installed units, unit capacity, baseline and installed efficiency, and full load heating hours.	Additional parameters useful for quality control and also for evaluation design, e.g. sampling.
Recommended M&V Method	Billing analysis (Option C) supported by telephone surveys and/or on-site inspections. Telephone surveys can be used to confirm installation and gather data on facility size and operating hours to support the billing analysis.	Billing analysis is only valid when the pre-existing (electric bills from the pre-retrofit period) is the appropriate baseline to be used in impact analysis.
Alternative M&V Methods	Adding on-site inspections to the basic method above improves confidence in building characteristics and supports collection of equipment nameplate data. Basic short-term measurements (Option A) can be added on electrical support equipment such as furnace fans and boiler pumps to refine savings estimates.	Metering methods would include time-of-use CT loggers and spot power measurements.
	Calibrated simulation modeling (Option D) is a high rigor alternative which is probably excessive for stand-alone gas heating equipment but would be appropriate for evaluating significant measures or those in a comprehensive package.	Natural gas sub-meters can be installed to isolate the heating equipment from other end uses.

1.2.8 C&I HVAC: Prescriptive Chillers

C&I HVAC: PRESCRIPTIVE CHILLERS

Savings Assumptions for Initial Gross Energy and Demand

Prevailing Algorithm for Energy and Demand:

kWh savings = Tons x Δefficiency x Annual operating hours
kW savings = Tons x Δefficiency x Demand factors

Notes on Algorithm:

1. "Δefficiency" (kW/ton) refers to the difference in efficiency between the baseline and installed equipment, i.e. ($Efficiency_{baseline}$ – $Efficiency_{installed}$).
2. "Annual operating hours" are either equivalent full load hours (EFLH) or cooling load hours (CLH).
3. The demand savings algorithm excludes operating hours and incorporates demand factors. These multipliers are called coincidence factors or load factors that modify the chillers peak kW consumption.
4. Prescriptive chiller savings algorithms neglect the impacts of support systems such as pumps, controls, and tower fans.

Description of Inputs:

Baseline Efficiency: Rated efficiency of baseline equipment as per energy code, established standards, or baseline study. Often in units of Energy Efficiency Ratio (EER) for air cooled chillers, kW/ton for water cooled chillers, or the dimensionless coefficient of performance (COP). Depending upon the application, an integrated part load value (IPLV) may be a more appropriate efficiency, particularly for annual energy savings. Baseline efficiencies vary greatly by type (air-cooled/water-cooled, reciprocating/screw/centrifugal) and size and should be supported by technical baseline studies.

Installed Efficiency: Rated efficiency of installed equipment as per manufacturer's performance data.

Full Load Cooling Hours: The ratio of annual cooling unit energy to nameplate peak demand, as informed by technical metering studies designed to update hours-of-use assumptions. Regional Technical Reference Manuals (TRMs) employ estimates ranging from 497 to 3653 full load hours, depending upon region and building type.

Demand Factors: Adjustments to rated demand for use in deriving coincident impacts; recommendation is to consolidate these discrete adjustments into combined Summer and Winter coincidence factors.

Loading: The ratio of peak observed to rated maximum load for a piece of equipment. A discrete factor to express equipment over sizing effects at the typical unit level.

Diversity: The ratio of the maximum combined demand to the sum of non-coincident demands across a group. A discrete factor which expresses the extent to which a group contributes to a combined maximum.

Summer Coincidence: The ratio of peak demand at the same time as a "summer" period to the peak demand across all periods. Summer coincidence factors range from 67% to 100% across the regional TRMs. Coincidence must reflect localized climate conditions and should be based upon technical research studies.

Winter Coincidence: The ratio of peak demand at the same time as a "winter" period to the peak demand across all periods. Winter coincidence factors range from 0% to 67% across the regional TRMs.

Opportunities for Improved Consistency or Areas Where Differences are Warranted:

1. Load factors are included in some calculations to account for average seasonal loading and/or oversized systems. By standardizing on Equivalent Full Load Hours, a load factor term is no longer needed.
2. Consolidate load, diversity, and coincidence factors into single factor combining all peak coincidence drivers.
3. Standardize Efficiency. kW/ton is most commonly used to estimate savings, but Integrated Part Load Value (IPLV) can be a better representation of seasonal performance under varying loads.
4. Facility type is unspecified across most TRMs but default operating hours rely on average operation of multiple facility types across regions. Identifying annual operating hours by selected facility types will provide more accurate estimation of prescriptive savings by capturing the unique operating profiles for each facility.

C&I HVAC: PRESCRIPTIVE CHILLERS

Summary of Recommended EM&V Methods

This category is limited to air-cooled and water-cooled chiller installations in commercial and industrial facilities as a prescriptive measure. Custom chiller installations are covered under C&I Custom Measures.

Aspect	Detailed Approach	Comments
Program Tracking	At a minimum: initial gross energy and demand savings, as well as initial net impacts as applicable. Additional: number of installed units, chiller capacity, baseline and installed efficiency, and full load cooling hours.	Additional parameters useful for quality control and also for evaluation design, e.g. sampling.
Recommended M&V Method	On-site inspections with partial measurements on a sample of program participants (Option A). Site visits with short-term metering can offer the most cost-effective approach to prescriptive chiller projects.	Metering methods include interval amp/kW recording or time-of-use loggers coupled with spot power measurements.
Alternative M&V Methods	An enhanced alternative to the above would be on-site inspections with metering that fully captures the entire chiller water system including supporting pumps and tower fans (Option B). Engineers can analyze hourly energy consumption for baseline and installation conditions in a dynamic spreadsheet model using Typical Meteorological Year (TMY) data.	Additional parameters of value include supply and return water temperature and water flow in gallons/minute.
	Calibrated simulation modeling (Option D) is a high rigor alternative which is especially effective at capturing measure interaction. Simulation modeling is particularly good at temperature dependent equipment, but requires a wealth of building and operational characteristics for an accurate model.	Metering would mirror Option B probably with whole premise interval kW and some space temperatures.

1.2.9 C&I HVAC: Unitary/Split

C&I HVAC: UNITARY/SPLIT

Savings Assumptions for Initial Gross Energy and Demand

Prevailing Algorithm for Energy and Demand:

Cooling Calculations:

kWh Saved = (Size in kBtu/hr) x (1/Efficiency$_{baseline}$ – 1/Efficiency$_{installed}$) x (Full Load Cooling Hours) / 1,000

Heating Calculations:

kWh Saved = (Size in kBtu/hr) x (1/Efficiency$_{baseline}$ – 1/Efficiency$_{installed}$) x (Full Load Heating Hours) / 1,000

Demand Calculations:

kW Saved = (Size in kBtu/hr) x (1/Efficiency$_{baseline}$ – 1/Efficiency$_{installed}$) x (Coincidence Factor) / 1,000

Notes on Algorithm:

1. Seasonal Energy Efficiency Ratio (SEER) is used to calculate cooling energy savings for air source heat pumps and AC units that are < 65,000 Btu/hr in size.
2. Energy Efficiency Ratio (EER) is used to calculate cooling energy savings for all water source heat pumps and for air source heat pumps and AC units that are < 65,000 Btu/hr in size. EER is also used for cooling demand savings.
3. Heating Seasonal Performance Factor (HSPF) is used to calculate heating savings for air source heat pumps < 65,000 Btu/hr.
4. COP (Coefficient of Performance) is used to calculate heating savings for units that are < 65,000 Btu/hr in size. COP is also used for heating demand savings.
5. Equivalent Full Load Hours (EFLH) is used to annualize savings. Separate operating hours are required for heating and cooling modes.

Description of Inputs:

Baseline Efficiency: Rated efficiency of baseline equipment as per energy code, established standards, or baseline study. Units vary as outlined above. Baseline efficiencies vary greatly by type (air conditioner/heat pump, air-source/water-source) and unit capacity and should be supported by technical baseline studies.

Installed Efficiency: Rated efficiency of installed equipment as per the Air-Conditioning, Heating, and Refrigeration Institute (AHRI) database or manufacturer data.

Full Load Cooling/Heating Hours: The ratio of annual cooling/heating unit energy to nameplate peak demand, as informed by technical metering studies designed to update hours-of-use assumptions. Regional Technical Reference Manuals (TRMs) employ widely varying estimates depending upon cooling/heating mode, region, and building type.

Demand Factors: Adjustments to rated demand for use in deriving coincident impacts; recommendation is to consolidate these discrete adjustments into combined Summer and Winter coincidence factors.

- **Loading**: The ratio of peak observed to rated maximum load for a piece of equipment. A discrete factor to express equipment over sizing effects at the typical unit level.
- **Diversity**: The ratio of the maximum combined demand to the sum of non-coincident demands across a group. A discrete factor which expresses the extent to which a group contributes to a combined maximum.
- **Summer Coincidence**: The ratio of peak demand at the same time as a "summer" period to the peak demand across all periods. Summer coincidence factors range from 44% to 100% across the regional TRMs. Coincidence must reflect localized climate conditions and should be based upon technical research studies.
- **Winter Coincidence**: The ratio of peak demand at the same time as a "winter" period to the peak demand across all periods. Regional estimates tend to assume 100% for heating mode, but this warrants improvement via further research.

Opportunities for Improved Consistency or Areas Where Differences are Warranted:

1. Operating hours is the most dynamic savings input variable, and a consistent method should embrace inputs that reflect operational diversity by location, building type, or vintage. A consistent regional approach can still reflect regional and operational differences: New York should continue using Equivalent

C&I HVAC: UNITARY/SPLIT
Savings Assumptions for Initial Gross Energy and Demand

Full Load Hours lookup tables by city, but Rhode Island need not.

2. Electric resistance operation is not included in savings estimates, but these savings should be included when water source heat pumps replace air-to-air systems.
3. Standardize Cooling Capacity Units on Btu/hr. Using capacity estimates in kBtu/hr instead of tons prevents rounding errors by excluding nominal designations (10 tons) that may cover several different units.
4. Eliminate Loading/Sizing Factor. Load factors are included in some calculations to account for over sizing systems in the field, but this can be addressed in the Equivalent Full Load Hours parameter.
5. Given the differences in climate across the Forum region, it is appropriate for specific states or utilities to continue to develop localized assumptions for cooling and heating hours due to local characteristics of climate, demographics, and behavior.

C&I HVAC: UNITARY/SPLIT
Summary of Recommended EM&V Methods

This category is limited to unitary HVAC installations in commercial and industrial facilities as a prescriptive measure. Unitary equipment covers split system AC, packaged systems, air-source heat pumps, and water source heat pumps. Custom unitary air conditioning applications are covered under C&I Custom Measures.

Aspect	Detailed Approach	Comments
Program Tracking	At a minimum: initial gross energy and demand savings, as well as initial net impacts as applicable. Additional: number of installed units, HVAC unit capacity, baseline and installed efficiency, and full load cooling *and heating* hours.	Additional parameters useful for quality control and also for evaluation design, e.g. sampling.
Recommended M&V Method	On-site inspections with partial measurements on a sample of program participants (Option A). Site visits with short-term metering can offer the most cost-effective approach to prescriptive chiller projects.	Metering methods include interval amp/kW recording or time-of-use loggers coupled with spot power measurements.
Alternative M&V Methods	An enhanced alternative to the above would be on-site inspections with metering that fully surrounds the measurement boundary (Option B). Engineers can analyze hourly energy consumption for baseline and installation conditions in a dynamic spreadsheet model using Typical Meteorological Year (TMY) data.	Interval kW metering on whole package units or both indoor/outdoor components of a split system.
	Calibrated simulation modeling (Option D) is a high rigor alternative which is especially effective at capturing measure interaction. Simulation modeling is particularly good at temperature dependent equipment, but requires a wealth of building and operational characteristics for an accurate model. May be a viable option for buildings with many HVAC units, zones, or solar coupling effects.	Metering would mirror Option B probably with whole premise interval kW and some space temperatures.

1.2.10 C&I HVAC: Other Measures

C&I HVAC: OTHER MEASURES

Savings Assumptions for Initial Gross Energy and Demand

Prevailing Algorithm for Energy and Demand:

kWh savings = (Size in Tons) x (Energy Savings Factor)

kW savings = (Size in Tons) x (Demand Savings Factor)

Notes on Algorithm:

1. The prevailing savings approach for all three measures - economizers, dual enthalpy controls, and programmable thermostats - is to employ "savings factors" which scale by HVAC unit size.

Description of Inputs:

Unit Size: HVAC unit capacity in tons of cooling. Nominal value from equipment nameplate.

Energy Savings Factor: Derived from an impact study. Estimates in Forum region Technical Reference Manuals (TRMs) vary greatly from 25 to 289 kWh/ton for dual enthalpy controls.

Demand Savings Factor: Most TRMs do not take credit for kW impacts. One TRM uses 0.289 kW/ton for dual enthalpy controls.

Summer Coincidence: Most TRMs do not take credit for kW impacts. One TRM uses 40% for summer coincidence. Recommend technical research to support savings factors and improve coincidence estimates.

Winter Coincidence: Most TRMs do not take credit for kW impacts. One TRM uses 0% for winter coincidence. Recommend technical research to support savings factors and improve coincidence estimates.

Opportunities for Improved Consistency or Areas Where Differences are Warranted:

1. The lack of reliable source documentation makes it difficult to compare savings assumptions and state what variables are the most accurate and reliable. Given the lack of uniformity between the models, assumptions, and savings factors, more measurement-based research (and perhaps simulation modeling) is warranted to improve consensus and confidence of HVAC economizer and control savings across the Forum region.

C&I HVAC: OTHER MEASURES
Summary of Recommended EM&V Methods

The Forum subcommittee for this project elected to limit this Other HVAC category to HVAC control measures such as thermostats, economizers, and dual-enthalpy controls. This category is limited to prescriptive installations in commercial and industrial facilities. Custom HVAC applications are covered under C&I Custom Measures.

Aspect	Detailed Approach	Comments
Program Tracking	At a minimum: initial gross energy and demand savings, as well as initial net impacts as applicable. Additional: number of installed units, unit capacity and efficiency, full load cooling hours, free cooling/setback hours.	Additional parameters useful for quality control and also for evaluation design, e.g. sampling.
Recommended M&V Method	On-site inspections with limited measurements on a sample of program participants (Option A). Site visits for HVAC control measures often focus upon accurately inspecting and verifying operation of the controls.	Metering methods may include strategically placed time-of-use loggers to verify controls.
Alternative M&V Methods	An enhanced alternative to the above would be on-site inspections with metering that fully captures the impacts of the control (Option B). An hourly impact analysis would isolate the control impacts from the monitored data stream and assess across a Typical Meteorological Year (TMY) dataset.	Metering would be interval kW measurements on the affected HVAC units. Advanced metering can include enthalpy readings and damper position.
	Calibrated simulation modeling (Option D) is a high rigor alternative which is especially effective at measure interaction but also control schema. Simulation modeling requires a wealth of building and operational characteristics for an accurate model. May be a viable option for buildings with many HVAC units and complex controls.	Metering would mirror Option B probably with whole premise interval kW and some space temperatures.

1.2.11 C&I Lighting (New Construction)

C&I LIGHTING (NEW CONSTRUCTION)

Savings Assumptions for Initial Gross Energy and Demand

Prevailing Algorithm for Energy and Demand:

kWh Saved = $(Quantity_{baseline} \times Watts_{baseline}) - (Quantity_{installed} \times Watts_{installed})$ / 1000 × (Annual Hours)

kW Saved = $(Quantity_{baseline} \times Watts_{baseline}) - (Quantity_{installed} \times Watts_{installed})$ / 1000 x (Coincidence Factor)

Notes on Algorithm:

1. Some Technical Reference Manuals (TRMs) stipulate the wattage reduction, utilizing a common Quantity term and substituting a ΔWatts or kW/unit term for $(Watts_{baseline} - Watts_{installed})$ in the equation above.
2. While some algorithms employ an in-service rate (ISR), it is less prevalent in the C&I sector than for residential; many C&I programs either exclude ISR or assume it to be 100%.

Description of Inputs:

Baseline Fixture Quantity: The number of fixtures in the corresponding baseline. The same as **Installed Fixture Quantity** for one-to-one replacements.

Baseline Fixture Wattage: Connected wattage of the baseline fixture. For C&I new construction, usually obtained from lookup tables or derived from lighting power density tables in American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) 90.1.

Installed Fixture Quantity: The number of installed fixtures.

Installed Fixture Wattage: The rated wattage of the installed fixture, inclusive of both lamp and ballast. Obtained from nameplate data.

Annual Hours: The number of operating hours for the fixture in a typical year. For C&I lighting, either site-specific or assigned by building type. Lighting hours-of-use studies by building type inform program estimates when site-specific hours are not available.

Summer Coincidence: The ratio of peak demand at the same time as a "summer" period to the peak demand across all periods. Summer coincidence factors range from 35% to 100% across the regional TRMs.

Winter Coincidence: The ratio of peak demand at the same time as a "winter" period to the peak demand across all periods. Winter coincidence factors range from 36% to 100% across the regional TRMs.

Opportunities for Improved Consistency or Areas Where Differences are Warranted:

1. A calculated savings methodology would facilitate regional consistency better than stipulated savings. Demand reductions by lighting technology are logical stipulations as inputs, and a consistent algorithm would allow for localized tuning of hours and coincidence for savings impacts.
2. Two distinct approaches are used in the region: lookups by building type and site-specific hours. A blended approach appears to be a logical and reasonable compromise between these two extremes. Site-specific lighting hours could be employed when available, but prescriptive lighting hours would default to lookup tables by building type or other relevant dimension.
3. In-Service Rate is a valid effect; the only question remains whether to account for it in preliminary or evaluated savings. Recommend dropping the ISR from the C&I lighting algorithm and capturing its effect in the gross evaluated realization rate.
4. There is an opportunity for the region to standardize on an interactive effects approach for C&I lighting. This can be an engineering-based interactive methodology or simply agreeing to include localized HVAC interaction factors in the standard C&I lighting algorithm.
5. Given demographic, geographic, program maturity, and behavioral differences in lighting usage across the Forum region, localized assumptions are prudent for lighting hours, peak coincidence, and HVAC interaction.

C&I LIGHTING (NEW CONSTRUCTION)
Summary of Recommended EM&V Methods

This category encompasses commercial and industrial lighting in new construction programs.

Aspect	Detailed Approach	Comments
Program Tracking	At a minimum: initial gross energy and demand savings, as well as initial net impacts as applicable. Additional: installed quantity and wattage, corresponding baseline, fixture location, annual operating hours, in-service rate, HVAC interaction factor.	Additional parameters useful for quality control and also for evaluation design, e.g. sampling. Fixture location is critical for evaluation.
Recommended M&V Method	On-site inspections with partial measurements on a sample of program participants (Option A). Complete inspection and count of all installed lighting with spot verification of lamp/ballast type. Characterize cooling/heating zones and equipment for assessment of HVAC interactive effects. Analysis with simple engineering models.	Time-of-use lighting loggers on a broad sample of fixtures, typically stratified by savings, room type, and or operating schedule.
Alternative M&V Methods	Some C&I lighting installations warrant very high, in-building sample rates or advanced interval metering (Option B). Examples include private office spaces with high uncertainty/diversity, hotel rooms/dormitories, and lighting systems with extensive controls. Interval kW meters have proven useful for recording load on lighting circuits with many, individual occupancy sensors or dimming controls. Analysis with simple engineering models or 8,760 spreadsheets for rigorous assessment of coincident impacts.	More liberal use of lighting loggers. Or: many commercial buildings isolate lighting systems in 277V power panels which can offer a prime opportunity for interval metering on large amounts of lighting.

1.2.12 C&I Lighting (Retrofit)

C&I LIGHTING (RETROFIT)

Savings Assumptions for Initial Gross Energy and Demand

Prevailing Algorithm for Energy and Demand:

kWh Saved = ($Quantity_{baseline}$ x $Watts_{baseline}$) – ($Quantity_{installed}$ x $Watts_{installed}$) / 1000 × (Annual Hours)

kW Saved = ($Quantity_{baseline}$ x $Watts_{baseline}$) – ($Quantity_{installed}$ x $Watts_{installed}$) / 1000 x (Coincidence Factor)

Notes on Algorithm:

1. Some Technical Reference Manuals (TRMs) stipulate the wattage reduction, utilizing a common Quantity term and substituting a ▫Watts or kW/unit term for ($Watts_{baseline}$ – $Watts_{installed}$) in the equation above.
2. While some algorithms employ an in-service rate (ISR), it is less prevalent in the C&I sector than for residential; most programs either exclude ISR or assume it to be 100%.

Description of Inputs:

Baseline Fixture Quantity: The number of pre-existing fixtures.

Baseline Fixture Wattage: Connected wattage of the pre-existing fixture for C&I retrofit.

Installed Fixture Quantity: The number of installed fixtures.

Installed Fixture Wattage: The rated wattage of the installed fixture, inclusive of both lamp and ballast. Obtained from nameplate data. Rarely measured independently.

Annual Hours: The number of operating hours for the fixture in a typical year. For C&I lighting, either site-specific or assigned by building type. Lighting hours-of-use studies by building type inform program estimates when site-specific hours are not available.

Summer Coincidence: The ratio of peak demand at the same time as a "summer" period to the peak demand across all periods. Summer coincidence factors range from 17% to 100% across the regional TRMs.

Winter Coincidence: The ratio of peak demand at the same time as a "winter" period to the peak demand across all periods. Winter coincidence factors range from 36% to 100% across the regional TRMs.

Opportunities for Improved Consistency or Areas Where Differences are Warranted:

1. A calculated savings methodology would facilitate regional consistency better than stipulated savings. Demand reductions by lighting technology are logical stipulations as inputs, and a consistent algorithm would allow for localized tuning of hours and coincidence for savings impacts.
2. Two distinct approaches are used in the region: lookups by building type and site-specific hours. A blended approach appears to be a logical and reasonable compromise between these two extremes. Site-specific lighting hours could be employed when available, but prescriptive lighting hours would default to lookup tables by building type or other relevant dimension.
3. In-Service Rate is a valid effect; the only question remains whether to account for it in preliminary or evaluated savings. Recommend dropping the ISR from the C&I lighting algorithm and capturing its effect in the gross evaluated realization rate.
4. There is an opportunity for the region to standardize on an interactive effects approach for C&I lighting. This can be an engineering-based interactive methodology or simply agreeing to include localized HVAC interaction factors in the standard C&I lighting algorithm.
5. Given demographic, geographic, program maturity, and behavioral differences in lighting usage across the Forum region, localized assumptions are prudent for lighting hours, peak coincidence, and HVAC interaction.

C&I LIGHTING (RETROFIT)
Summary of Recommended EM&V Methods

This category encompasses commercial and industrial lighting in retrofit programs.

Aspect	Detailed Approach	Comments
Program Tracking	At a minimum: initial gross energy and demand savings, as well as initial net impacts as applicable. Additional: installed quantity and wattage, corresponding baseline, fixture location, annual operating hours, in-service rate, HVAC interaction factor.	Additional parameters useful for quality control and also for evaluation design, e.g. sampling. Fixture location is critical for evaluation.
Recommended M&V Method	On-site inspections with partial measurements on a sample of program participants (Option A). Complete inspection and count of all installed lighting with spot verification of lamp/ballast type. Characterize cooling/heating zones and equipment for assessment of HVAC interactive effects. Analysis with simple engineering models.	Time-of-use lighting loggers on a broad sample of fixtures, typically stratified by savings, room type, and or operating schedule.
Alternative M&V Methods	Some C&I lighting installations warrant very high, in-building sample rates or advanced interval metering (Option B). Examples include private office spaces with high uncertainty/diversity, hotel rooms/dormitories, and lighting systems with extensive controls. Interval kW meters have proven useful for recording load on lighting circuits with many, individual occupancy sensors or dimming controls. Analysis with simple engineering models or 8,760 spreadsheets for rigorous assessment of coincident impacts.	More liberal use of lighting loggers. Or: many commercial buildings isolate lighting systems in 277V power panels which can offer a prime opportunity for interval metering on large amounts of lighting.

1.2.13 C&I Motors

C&I MOTORS

Savings Assumptions for Initial Gross Energy and Demand

Prevailing Algorithm for Energy and Demand:

kWh savings = HP x 0.746 x (1/$Efficiency_{baseline}$ – 1/$Efficiency_{installed}$) x (loading) x (annual hours) / 1,000

kW savings = HP x 0.746 x (1/$Efficiency_{baseline}$ – 1/$Efficiency_{installed}$) x (loading) x (demand factors) / 1,000

Notes on Algorithm:

1. Standard motor algorithm; highly consistent in Forum region.

Description of Inputs:

Baseline Efficiency: Rated efficiency of baseline motor as per EPACT 1992. Lookup tables by motor horsepower (HP), type (open drip proof, totally enclosed fan cooled), and speed (rpm).

Installed Efficiency: National Electrical Manufacturers Association (NEMA) efficiency of installed motor as per nameplate data.

Loading: The average percent motor loading. While often ball-parked at 70-80%, best informed by spot power measurement of motor under typical loading conditions.

Annual Hours: The number of hours per year that the motor operates. While some prescriptive motor programs provide for site-specific estimates of operating hours, most Technical Reference Manuals (TRMs) provide default lookup hours by 12-60 facility types and 3-4 end uses.

Summer Coincidence: The ratio of peak demand at the same time as a “summer” period to the peak demand across all periods. Summer coincidence factors vary widely for prescriptive motors across the Forum region.

Winter Coincidence: The ratio of peak demand at the same time as a “winter” period to the peak demand across all periods. Winter coincidence factors vary widely for prescriptive motors across the Forum region.

Opportunities for Improved Consistency or Areas Where Differences are Warranted:

1. Stay on Track. The efficient motor measure is already close to a regional standard. The availability and uniformity of base and installed motor data has been widely adopted making only minor adjustments necessary to create a regional measure.
2. Some TRMs prescribe motor operating hours for an extensive list of facility types and applications, while others are more limited. Shared research and operating hour assumptions may help expand efficiency offerings for programs that do not offer non-HVAC prescriptive motors.
3. Do not neglect loading factor; use site-specific when available. The loading factor accounts for motor over sizing and prevents the assumption that all motors operate continuously at full load.

C&I MOTORS
Summary of Recommended EM&V Methods

This category is limited to the installation of premium efficient motors in commercial and industrial facilities as a prescriptive measure. Motors installed in conjunction with other measures such as with variable speed drives are not included in this document.

Aspect	Detailed Approach	Comments
Program Tracking	At a minimum: initial gross energy and demand savings, as well as initial net impacts as applicable. Additional: number of installed units, motor horsepower, end use and application (e.g. HVAC supply fan), location, baseline and installed efficiency, loading factor, and annual operating hours.	Additional parameters useful for quality control and also for evaluation design, e.g. sampling. Motor location is critical for evaluation.
Recommended M&V Method	On-site inspections with partial measurements on a sample of program participants (Option A). Basic site visits with time-of-use metering offers the most defensible and cost-effective approach to constant-speed, prescriptive motors.	Metering methods include time-of-use CT or "magnetic field" loggers and spot power measurements.
Alternative M&V Methods	An enhanced alternative to the above would be on-site inspections with interval kW metering that tracks the electrical performance of the motor throughout its load range (Option B). This added rigor captures part-load efficiency effects that tend to be neglected in a time of use (TOU) metered approach with simple engineering models.	Metering would be interval kW measurements for a reasonable duration to span a variety of motor loading situations.

1.2.14 C&I Variable Speed Drives

C&I VARIABLE SPEED DRIVES

Savings Assumptions for Initial Gross Energy and Demand

Prevailing Algorithm for Energy and Demand:

kWh Saved = Motor horsepower (HP) x energy savings factor (ESF) x annual operating hours
kW Saved = Motor horsepower x demand savings factor (DSF)

Notes on Algorithm:

1. All variable speed drive algorithms in the Forum region boil down to a "savings factor" method, however most programs differentiate factors by building type, equipment type, and/or fan/pump type.
2. The most complex prescriptive variable speed drive (VSD) method utilizes an eleven-bin analysis based on percentage of flow. This adds greater resolution to the calculations, but the underlying algorithm remains consistent.

Description of Inputs:

Motor Horsepower: Motor size in nominal horsepower. From nameplate.
Energy Savings Factor: Estimated from impact studies or theoretical engineering models. Estimates range from 745-1,746 kWh/hp.
Demand Savings Factor: Estimated from impact studies or theoretical engineering models. Estimates range from 0.098-0.744 kW/hp.
Annual Hours: Estimated from impact studies or theoretical engineering models. Estimates range from 1,119-8,670 hours/year.
Summer Coincidence: The ratio of peak demand at the same time as a "summer" period to the peak demand across all periods. Summer coincidence factors vary from 0-100% for prescriptive VSDs depending upon the building type and drive application.
Winter Coincidence: The ratio of peak demand at the same time as a "winter" period to the peak demand across all periods. Winter coincidence factors vary from 0-100% for prescriptive VSDs depending upon the building type and drive application.

Opportunities for Improved Consistency or Areas Where Differences are Warranted:

1. If methodological consistency is a regional objective, a line may need to be drawn between prescriptive and custom VSDs, likely with a simpler line-item calculations and savings factors for prescriptive approach.
2. To improve portability of the VSD method, develop standardized kW/hp factor(s) and localized assumptions for operating hours and peak coincidence. Some algorithms provide a range of default operating hours while others embed annual operation in the "ESF" savings factor.
3. The region would benefit from some standardization, for Technical Reference Manuals (TRMs) vary widely in the range of equipment and size (motor horsepower) covered by the prescriptive variable speed drive application. Eleven types of equipment are covered in one TRM while another list only two applicable types. Installations outside the "standard" offerings simply would become a Custom measure.
4. Similarly, a common set of facility types would facilitate regional methodological consistency. The number of discrete facility types ranges from two to sixty amongst TRMs reviewed.
5. Any compliance or exclusion criteria should be clearly documented. The TRMs clearly identify motor size and application but do not always document exclusion criteria.

C&I VARIABLE SPEED DRIVES Summary of Recommended EM&V Methods		
This category is limited to variable speed drives (VSD) installations in commercial and industrial facilities as a prescriptive measure. Custom VSD applications are covered under C&I Custom Measures.		
Aspect	**Detailed Approach**	**Comments**
Program Tracking	At a minimum: initial gross energy and demand savings, as well as initial net impacts as applicable. Additional: number of installed units, motor horsepower, end use and application (e.g. HVAC supply fan), location, savings factors, and annual operating hours.	Additional parameters useful for quality control and also for evaluation design, e.g. sampling. VSD location is critical for evaluation.
Recommended M&V Method	On-site inspections with interval kW metering that tracks the electrical performance of the motor/VSD combination throughout its load range (Option B). Lesser rigor would not capture the variability intrinsic to a VSD application.	Metering would be interval kW measurements for a reasonable duration to span a variety of loading situations.
Alternative M&V Methods	Calibrated simulation modeling (Option D) is a high rigor alternative which is especially effective at measure interaction but also control schema. Simulation modeling requires a wealth of building and operational characteristics for an accurate model. May be a viable option for facilities with many VSDs on HVAC systems units.	Metering would mirror Option B perhaps with whole premise interval kW and some space temperatures.

Attachment 193.2

REFER TO LIVE SPREADSHEETS

Provided in electronic format only

(accessible by opening the Attachments Tab in Adobe)

Attachment 193.3

43.2.4 On page 35 Table 3.5 Summary Information Other Utilities DSM Activity of the Application it shows the DSM Funding Treatment: O&M, rate base, and public purpose fund.

43.2.4.1 For these utilities that include the costs into rate base/capital what are the amortization periods.

Response:

Please refer to the response to BCUC IR 1.43.2.4.2

43.2.4.2 For these utilities that rate base its DSM expenditures please provide information on the amounts that are capitalized annually and the amounts expensed, if any.

Response:

The table below provides the details on amortization periods for utilities that include the costs into rate base/capital

Utility Name	Amortization Period	Capitalized vs. expensed
BC Hydro	10 yrs	Capitalized but DSM expenditures associated with cancelled programs are written off in the year in which the program is cancelled
FortisBC	10 yrs	Capitalized
Manitoba Hydro	15 yrs	Expensed but spread over a 15 year amortization period
Union Gas/Enbridge Gas Distribution	n/a	Included in rate base; earn based on an incentive mechanism

Further details for each utility are provided below.

BC Hydro

"Costs are capitalized and amortized to appropriately match the costs with energy savings benefits over future years, not to exceed ten years.

Costs incurred in the concept development phase are not capitalized as there is no assurance that any program will be accepted for development and implementation.

Program-specific and non-specific portfolio development and implementation costs are capitalized and amortized over a period not to exceed ten years. Amortization commences in the year following the year in which the expenditure is incurred. DSM expenditures associated with cancelled programs are written off in the year the program is cancelled. Costs that are not capitalized are expensed as OMG&A in the period incurred.”

Source: http://www.bchydro.com/rx_files/info/info45426.pdf, Section 8, p71

DSM expenditure in 2007 was $4.942 million in operating costs and $47.313 in deferred capital.

Source: BC Hydro PowerSmart, “Report on Demand-Side Activities for the Twelve Months ending March 31, 2007”

FortisBC

All DSM expenditures are capitalized, including incentives, labour, expenses including advertising, but none are O&M. About ~10% of the Technical Advisors time is designated as Key Account management and thus O&M. However KAM is for non-DSM matters, so the O&M expense will go to Customer Services.

Also it is the *net* DSM expenditure, after income tax effect (~31%), that is capitalized in rate-base. So a $2.4m nominal spend translates into $1.6m rate base addition.

Source: Email Correspondence, Keith Veerman, FortisBC PowerSense Department.

Manitoba Hydro

The Terasen Utilities had asked Manitoba Hydro to clarify this, below is their response:

None of Centra's[12] DSM costs are capitalized. All of Centra's DSM costs are expensed, but they are spread out over the 15 year amortization period. Manitoba Hydro (the electrical operation) does not earn a return on DSM expenditures because as a crown corporation it is regulated under a cost of service methodology (not rate base/rate of return). Manitoba Hydro's return is based on long term forecasts and rates designed to leave an adequate operating reserve and debt/equity ratio. Return on rate base or like assets is not considered when determining rates. It should be noted that Centra also now regulated under a cost of service methodology but this is very recent and the Manitoba PUB still looks at rate base in Centra's filings and rate base is used as an allocater in its cost of service study.

Source: Email Correspondence, Brad De Ryck, Gas Rates & Regulatory Department Manitoba Hydro.

[12] Centra is the natural gas subsidiary of Manitoba Hydro.

Union Gas and Enbridge Gas Distribution

Both include costs in their rate base, but do not capitalize the expenditure. Uses a Variance Account to reconcile expenditure and revenue at the end of each financial year; neither company earns on the DSM revenue but rather through the SSM mechanism.

http://www.oeb.gov.on.ca/documents/cases/EB-2005-0437/decision-231205.pdf (Section 4 refers to the SSM and Section 6 to the DSMVA).

43.2.4.3 Are the Terasen Utilities aware of any utility that amortizes DSM costs over a 20 year or greater period? If so, please provide the name of the utility and the details of the DSM program.

Response:

Further research failed to uncover any examples where utilities are using or proposing amortization periods as long as 20 years. Note, however, that the 20 year period selected by the Companies is based on estimates of "the life of the assets". There are other instances where utilities have adopted the "life of the asset" approach, but arrived at a different conclusion as to the life of the assets (i.e. a shorter amortization period) in those particular circumstances. The approach is consistent with the Commission's DSM Accounting Policy and the Commission has approved this approach for FortisBC and BC Hydro.

Please also refer to the responses to BCUC IRs No. 1, Questions 10.2, 42.1 and 43.2.4.2. Similarly, the Nevada Administrative Code, NAC 704.9523[13], charges the Public Utility Commission with determining an amortization period that is "consistent with the life of the investment."

43.2.4.4 What is a "public purpose fund" and how is it generally funded? Would a public purpose fund be suitable for the Terasen Utilities?

[13] http://www.leg.state.nv.us/NAC/NAC-704.html#NAC704Sec9523conci

Response:

In general, a "Public Purpose Fund" (PPF) is a mechanism to raise revenues from utility customers for a specific purpose such as DSM, low-income support or the funding of renewable energy resources. The PPF charge typically appears as a separate line-item on the customer bill rather than being rolled into the rates, so it shows up as a rate rider in the utility's tariff. There are different variations on PPFs; in some cases, PPFs fund DSM activity by a central agency. In others, PPFs fund utility DSM activity. More information on this can be found in Appendix 4.

In the case of Oregon, the Public Purpose Fund was established by legislation – by Senate Bill 1149, which was approved in 1999 and which came into effect March 1, 2002. No such statutory basis exists for the Terasen Utilities to fund DSM activity through a PPF – this is one reason that a PPF would not be an appropriate funding vehicle for the Terasen Utilities EEC activity.

In British Columbia, each utility has applied for and managed its own DSM funding according to its particular circumstances and Commission approvals received. British Columbia utilities have also rolled their DSM funding into revenue requirements and rates in keeping with Commission orders. It would not be appropriate for some utilities in the province to be required to fund their DSM programs in the manner of a PPF while others rolled those expenditures into rates. The normal utility regulatory proceedings dealing with revenue requirements, rate design, resource acquisition and compliance reporting provide suitable opportunities to ensure that DSM funding is reviewed, approved and fairly charged in rates. The Energy Plan does not make mention of PPFs, but rather in Policy Action # 3 states that the Ministry will ensure that appropriate incentives are in place to encourage investor-owned utilities to pursue cost-effective DSM programs. The Companies believe that the financial treatment proposed in the Application provides for that financial incentive.

43.2.4.5 Please discuss the pros and cons of the various DSM funding treatments: O&M, rate base, and public purpose fund.

Response:

The pros and cons of the DSM funding treatments in general are discussed below, however in every jurisdiction, nuances in ratemaking exist that impact how the pros and cons laid out below would be experienced or not by each individual utility.

O&M:

Pros: The DSM expenditures are recovered in rates in the same fiscal period in which they are incurred so there is no residual to recover in future fiscal periods.

Cons: Expensing the DSM expenditures in O&M does not allow matching of the EEC costs with the DSM benefits produced which will persist over a number of years. Current customers pay for benefits that will be received by future customers.

To the extent there is year to year variability in the level of DSM spending, expensing the DSM expenditures in O&M will introduce rate volatility.

In order to encourage a utility to make DSM expenditures, an accompanying incentive mechanism is needed, which can be more difficult to administer than including expenditures in rate base and amortizing.

Rate Base:

Pros: The DSM costs are amortized in rates over a similar period for which the benefits of the DSM programs are expected to persist.

Rate volatility from varying levels of DSM spending is avoided. Please refer to the response to BCUC IR 1.10.2. The rate impact of the rate base approach is lower initially and is smoothed relative to the expensing approach. In addition, the present value of the revenue requirements from the rate base approach is lower for customers assuming customers have a time value of money preference based on a higher discount rate than the utility's after-tax cost of capital.

Cons: Effect of DSM spending on rates persists into the future with no related tangible assets on the Companies' books

Public Purpose Fund:

Pros: A public purpose fund provides a relatively straightforward and transparent means of raising funds for programs and activities considered worthy of such support.

Cons: A public purpose fund requires the establishment of a separate organization to administer the collection of funds and the carrying out of programs. This has the potential to become bureaucratic and will likely alter the utility-customer relationship in terms of the provision of DSM services. Please refer to the response to BCUC IR 1.43.2.4.4

Please note that, unlike in Oregon, there is no legislative basis for a Public Purpose Fund in British Columbia making this approach impractical. Please refer to the response to BCUC IR 43.2.4.4.

43.2.4.6 Please describe the currently approved DSM incentive mechanism used by Union Gas and Enbridge Gas Distribution in Ontario.

Response:

The OEB has mandated an incentive mechanism, the Shared Savings Mechanism ("SSM"). This incentive mechanism rewards the utility for success in DSM. The utility receives a portion of all societal benefits resulting from the DSM programs. The monies are collected from the customer and are later distributed to the shareholder.

The formula for determining the SSM payout is laid out in the OEB's decision EB 2006-0021. The table below illustrates the shape of the curve that determines the incentive amount paid out to each utility. As the utilities increase their Total Resource Costs ("TRC"[14]) benefits, they have achieved, the payout increases up to a maximum of $8.5 million. This amount will increase annually by the Ontario Consumer Price Index ("CPI") as determined in October of the preceding year (i.e., the 2008 cap will increase based on CPI at October 2007[15]). The indexing target used in the SSM calculation for 2007 for EGD is $150

[14] TRC test is a benefit-cost test which measures the net costs of a demand-side program as a resource option based on the total costs of the program. It is satisfied when the cost of energy saved through DSM is less than the cost of providing the same energy from new supply.

[15] http://www.oeb.gov.on.ca/documents/cases/EB-2006-0021/dec_dsm_250806.pdf

million, and for Union Gas, $188 million. Targets for subsequent years are set according to a formula.

% of Annual Target achieved	**Payout**
Up to 25%	$225,000
Up to 50%	$675,000
Up to 75%	$2,250,000
Up to 100%	$4,750,000
Up to 125%	$7,250,000
Above 125%	$8,500,000 [1]

[1] Savings above 125% are capped at $8.5 million

Current regulatory settlements for both utilities span three years (2007 to 2009).

Please see the Companies response to BCUC IR 1.10.2.

65.0 Reference: Exhibit B-1, Appendix 1, CPR, DSM Incentive, p. E-xii

65.1 Please confirm that no DSM incentive will be applicable to the programs which may result from this application.

Response:

The EEC Application does not request a DSM incentive for the proposed Energy Efficiency and Conservation program areas outlined in the Application. Rather, the Companies are requesting Commission approval to treat all incremental EEC expenditures as equivalent to capital as outlined in Sections 1.4.2 and 6.12 of the Application. Please also see BCUC IR 1.10.2 for further discussion of capitalization.

29.0 Reference: Exhibit B-2, BCUC IR#1 43.2.4.6; and Exhibit B-1, Appendix 4, p. 29

The response to BCUC IR#1 43.2.4.6 states: "The OEB has mandated an incentive mechanism, the Shared Savings Mechanism ("SSM"). This incentive mechanism rewards the utility for success in DSM." The incentive is based on a sliding scale where higher performance is rewarded with a higher payout.

29.1 Do the Terasen Utilities consider the SSM as an acceptable incentive to align both shareholder and ratepayer interests in achieving the maximum TRC result for the DSM spend?

Response:

The Terasen Utilities believe that the appropriate treatment for the EEC expenditures is to capitalize the expenditures as described in section 6.12, p.80 of the Application (Exhibit B-1) and reiterated in BCUC IR#1 10.2. Further, as stated on p.81 of the Application, the Companies feel that setting a target on which an incentive would be paid out could prove to be challenging and contentious given the Companies have not previously established a target for energy savings from EEC expenditures.

Capitalization of EEC expenditures is also consistent with the Energy Conservation and Efficiency Policies outlined in the "The BC Energy Plan: A Vision for Clean Energy Leadership". Policy item #2 (Ensure a coordinated approach to conservation and efficiency is actively pursued in British Columbia). The Terasen Utilities believe that the capitalization of the Companies' EEC expenditures would be consistent with the treatment approved for the two major electric utilities, BC Hydro and Fortis BC and would help the utilities develop a coordinated approach to energy conservation. Additionally, the accounting treatment proposed by the Companies will allow the Terasen Utilities to earn a return on the EEC expenditures, which is consistent with Section 60 (b)(ii) of the Utilities Commission *Act* that states:

> *"Provides to the public utility for which the rates is set a fair and reasonable return on any expenditure made by it to reduce energy demands"*

It is the understanding of the Companies that under the OEB mandated SSM, EEC expenditures are expensed in the year incurred and shareholders only receive an incentive in the event that program results exceed certain criteria. This means that shareholders do not necessarily earn a return on the expenditures made for energy efficiency and conservation programs. This result would be contrary to the Utilities Commission Act. Accordingly, the Companies are of the view that the SSM is not an acceptable incentive mechanism to align shareholder and ratepayer interests for utilities in British Columbia.

29.2 Would the SSM be better than capitalizing to rate base, in terms of aligning the shareholder incentive to maximize TRC results for the ultimate goal of energy conservation? Please discuss.

Response:

Please see response to BCUC IR 2.29.1.

29.3 If the Commission determined that an incentive mechanism would be a superior method of rewarding the utilities for promoting and undertaking cost-effective DSM, what form of incentive mechanism would the Companies propose? Please provide a detailed description of the type of mechanism.

Response:

The Companies are receptive to a mechanism that provides a fair return to shareholders and provides optimal benefit for its customers. The Companies are of the view that the financial treatment proposed in its Application is superior to an incentive mechanism, for the purposes of rewarding utilities in British Columbia for promoting and undertaking cost-effective EEC programs. For a further discussion, please refer to the response to BCUC IR 2.29.1.

As previously discussed, successful DSM will contribute to reduced demand and future expansion requirements and therefore restrict the Companies' ability to expand its business in the future. Incentive mechanisms are unlikely to provide the utility the same opportunity to generate additional future earnings consistent with system expansion. The Companies believe that the proposed capitalization of EEC expenditures helps to alleviate the dis-incentive that successful DSM programs could create.

However, in an attempt to be responsive to the hypothetical scenario set out in the question, the Companies are of the view that there may be some merit in an incentive mechanism similar to that approved for FortisBC (please refer to the response to BCUC IR 2.29.4 below), which allows for incentives over and above a return on its EEC expenditures.

29.4 FortisBC's current DSM incentive mechanism is described in Exhibit B-1, Appendix 4, at pages 8 and9. Please provide the results in terms of target and actual savings, target and actual costs, and incentive received, for the most recent five years available. Please comment on whether Terasen would consider such a mechanism to be acceptable in its case? If not, why not?

Response:

The results[17] in terms of target and actual savings, target and actual costs, and incentive received for the years 2002-2007 are listed below:

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[17] Source: Email correspondence, Keith Veerman, PowerSense Department, FortisBC, August 2008.

To December 31, 2007; Energy Savings by Year (GW.h)

Year	Plan	Actual	% of Plan Achieved
2002	14.1	16.3	116%
2003	15.6	18.5	119%
2004	14.7	21.3	145%
2005	19	23.9	126%
2006	20.4	23.1	113%
2007	21.8	27.9	128%

Cumulative Fortis Costs

To December 31, 2007; Cost by Year ($000)

Year	Plan	Actual	% of Plan	$/MWh
2002	$ 1,661	$ 1,555	94%	95
2003	$ 1,840	$ 1,706	93%	92
2004	$ 1,814	$ 1,989	110%	93
2005	$ 1,835	$ 2,350	128%	98
2006	$ 2,234	$ 2,241	100%	97
2007	$ 2,474	$ 2,549	103%	91

DSM Incentive Earned

To December 31, 2007; Incentive by Year ($)

Year	Actual
2002	$ 61,810
2003	$ 69,000
2004	$ 58,000
2005	$ 99,000
2006	$ 76,400
2007	$ 119,500

As stated in the response to BCUC IR 2.29.3, the Companies are receptive to a mechanism that provides a fair return and provides optimal benefit for its customers. The Companies are of the view that the above noted mechanism contains components that may assist in meeting that goal. In the PowerSense model, EEC expenditures are treated as deferred expenditures. These deferred expenditures are factored into the rate base and FortisBC earns an approved rate of return over the approved amortization period. These earnings are in addition to any earnings that FortisBC might receive as an incentive as a result of the Shared Savings Mechanism ('SSM") that FortisBC currently uses.

As illustrated in the chart above, FortisBC has been successful in maximizing the resource savings acquisition per dollar spent and has received an incentive for each of the last 5 years.

29.5 The Performance Incentive Mechanism (PIM) and the Global Energy Efficiency plan Performance Incentive (GEEP) is described for Gaz Metro in Exhibit B-1, Appendix 4, at pages 20-22. Please comment on whether Terasen would consider such a mechanism to be acceptable in its case? If not, why not?

Response:

Under Gaz Metro's PIM, the utility receives an incentive based on the projected cost of service using a formula which includes consideration for the impact on volumes of energy efficiency measures. This incentive is based on a Reference Formula which allows Gaz Metro to retain a portion of the difference between the cost of service and the result obtained by applying the Reference Formula. If the costs of service exceed the result obtained by applying the Reference Formula, Gaz Metro has to either offset the difference or return a portion to the ratepayers.

The Reference Formula is based on the previous year's revenues plus inflation and adjustments for factors that affect volumes. One of these factors is the impact on volumes of energy efficiency measures. Gaz Metro receives compensation for 90 per cent of volume variations attributed to energy efficiency measures. Under the GEEP, Gaz Metro is tied to a targeted annual savings for a five year period. If Gaz Metro does not reach its goal in any one year, they do not receive a full yearly payout but a prorated incentive.

The Gaz Metro PIM and GEEP would not be an appropriate mechanism for the Companies to consider because under this plan, all EEC expenditures are expensed, and the shareholder may not necessarily earn a fair and reasonable return on its EEC expenditures.

29.6 Appendix 4 (page 29) of Exhibit B-1 states that the incentive mechanism in place "…ensures that program savings are real and verified and imposes penalties for sub-standard performance…."

Does Terasen support an approach that ensures that program savings are real and verified and imposes penalties for sub-standard performance? Why or why not?

Response:

The Companies support an approach that ensures that program savings are real and verified. To this end, the Companies have proposed a portfolio approach for the evaluation of its EEC programs. The Companies are seeking Commission approval for the overall incremental expenditures as outlined in Table 1.4.1 of the Application and have asked for the flexibility to redirect funds from one program area to another program area that the Companies believe will more readily meet the goals based on the assessment criteria outlined in the Application.

If the Companies receive Commission approval for the EEC spending levels as requested in the Application, cumulative annual savings in nominal (as opposed to present value) GJs is projected to result in savings reaching 6.4 million GJs by 2016. While this is a substantial savings, the Companies have not proposed an incentive based mechanism in its Application. The Companies believe that the optimum benefit for the ratepayer would be the approval of the Companies' proposed financial treatment. The Companies are of the view that imposition of penalties to shareholders will not result in greater alignment between shareholder and customer interest with respect to EEC expenditures. Additionally, any regime that included penalties for the Terasen Utilities would create a major difference between the programs of the Companies and the large electric utilities in the Province. This would not be appropriate in the opinion of the Companies.

Attachment 196.1

(Provided in electronic format only due to
document size and in order to conserve paper)

CONSERVATION POTENTIAL REVIEW-2010
FortisBC

Residential Sector
Energy-efficiency, Alternative Energy & Customer Behaviour Opportunities

Submitted to
FortisBC

Submitted by
ICF Marbek

In association with
Habart Associates

April 18, 2011

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Executive Summary

Background and Objectives

This Conservation Potential Review (CPR) provides FortisBC Energy Utilities ("FortisBC") with a comprehensive planning document that the company can use on an ongoing basis to:

- Develop a long-range energy-efficiency strategy
- Design and implement energy-efficiency programs
- Assess the impact of energy-efficiency programs on both peak and annual loads
- Set annual energy-efficiency targets and budgets.

Summary of Findings

This report covers the results for the Residential sector; results for the Commercial and Industrial sectors are provided in separate reports.

The study findings confirm the existence of potential cost-effective natural gas efficiency improvements in British Columbia's Residential sector, but highlight the increasing challenges in finding opportunities. In the *most likely* and *aggressive* Achievable scenarios energy-efficiency improvements would provide between 3,329,000 and 5,836,000 GJ/yr. of savings in 2030 as well as peak day load reductions of approximately 34,000 to 59,000 GJ.

These potential savings are smaller than those found in previous studies, both because of the success of previous program initiatives on the part of FortisBC and other utilities, and because of new standards for furnaces, water heaters, and new home construction. Consequently, there is a need to look beyond the "easy" and the "conventional" to more innovative approaches to seeking continued energy-efficiency and GHG reduction opportunities.

As an example of one possible approach, this study explored the potential offered by early retirement of gas furnaces. This measure was included in the Achievable Potential at the request of FortisBC. This is because, although the measure is not considered cost effective when viewed through conventional DSM screens (it does not pass the total resource cost [TRC] test as applied in this study), fully 76% of FortisBC's customers (or 91% of those who heat with gas furnaces) have standard- and mid-efficiency furnaces. It is the desire of FortisBC to offer its customers a program to encourage these customers to replace their standard- and mid-efficiency furnaces before the end of equipment life with high-efficiency furnaces.

Partly because of the inclusion of the furnace early retirement measure, space heating accounts for nearly 80% of the total energy savings in the two Achievable Potential scenarios. The largest contributor to these savings is the early retirement of gas furnaces, which accounts for approximately half of the total Achievable Potential savings. Improvements in gas fireplace efficiency offer 12%-13% of the total energy savings in the two Achievable Potential scenarios, swimming pool heater efficiency offers 6%, and water heating efficiency offers 3% of the savings.

Scope

Sector Coverage: The study addresses three sectors: Residential (this report), Commercial/Institutional[1] and Industrial. In contrast to the 2006 CPR, which excluded FortisBC's (then Terasen Gas's) 300 largest manufacturing accounts, this CPR includes all of FortisBC's customers.

Geographical Coverage: The study results are presented for the total FortisBC service region and for the five service areas of: Lower Mainland, Vancouver Island, Whistler, Northern Inland and Southern Inland.

Study Period: The Base Year for this study is calendar year 2010. The time period covered by this study is to 2030, with milestones at the intervening years of 2015, 2020 and 2025.

Technologies: The study addresses energy-efficiency, customer behaviour and alternative energy options such as renewables and combined heat and power technologies.

Relation to Previous B.C. CPRs: This study builds on the substantial body of information and modelling work prepared in previous CPR studies conducted for FortisBC (then Terasen Gas) (2006) and BC Hydro (2007). The 2006 FortisBC study was intended to mesh with the BC Hydro study from 2007 and therefore included all customers of either utility, not just FortisBC customers. This study includes only FortisBC natural gas customers because this permitted the study to make better use of the recently completed energy end-use studies.

Approach

The detailed end-use analysis of energy-efficiency opportunities in the Residential sector employed two linked modelling platforms: HOT2000, commercially supported, residential building energy-use simulation software; RETScreen, a commercially supported, renewable energy systems modelling tool; and RSEEM (Residential Sector Energy End-use Model), a Marbek in-house spreadsheet-based macro model.

The major steps involved in the analysis are shown in Exhibit ES -1 and are discussed in Section 2. As illustrated, the results of this CPR study, and in particular the estimation of Achievable Potential, support on-going DSM planning work. However, it should be emphasized that the estimation of Achievable Potential is not synonymous with either the setting of specific program targets or with program design.

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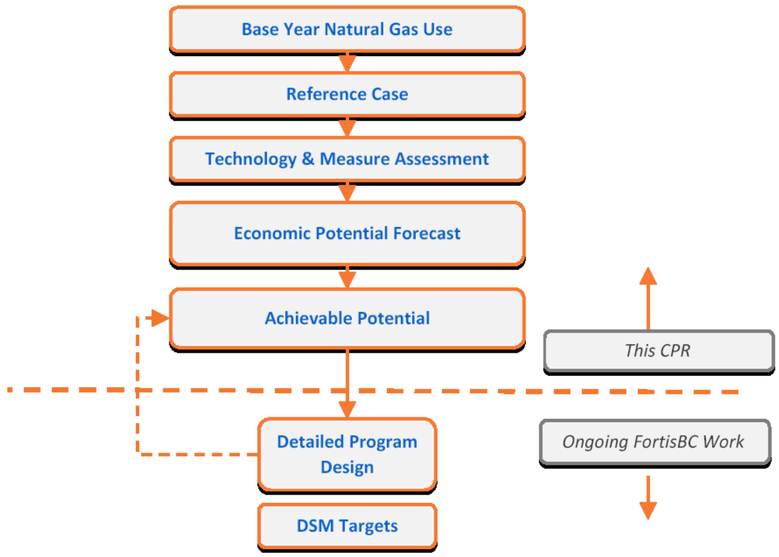
[1] Throughout this report, use of the word "commercial" includes both commercial and institutional buildings unless otherwise noted.

Exhibit ES 1 CPR 2010: Main Analytic Steps



Base Year Natural Gas Use[2]

In the Base Year of 2010, FortisBC's residential customers consumed approximately 74,440,000 GJ. Exhibit ES 2 and Exhibit ES 3, respectively, provide additional details on the major end uses and sub sectors where Residential sector natural gas consumption occurs.

Exhibit ES 2 shows that space heating accounts for approximately 62% of the total residential natural gas use. Domestic hot water heating is the next largest residential end use, accounting for approximately 19% of total residential natural gas use, followed by fireplaces (15%). Cooking, swimming pool heaters, clothes dryers, and other gas uses, combined, account for about 4% of residential natural gas use. The "other gas uses" end use includes a variety of residential uses such as gas barbecues, outdoor fireplaces, garage or patio heaters, and outdoor lights.

Exhibit ES 3 shows that single-family dwellings (SFD) and duplexes account for about 92% of residential natural gas consumption followed by attached/row houses at 6%. Mobile/other dwellings account for the remaining 2% of residential natural gas use.

[2] Readers attempting to compare these results with the CPR study completed for FortisBC (then Terasen Gas) in 2006 should be aware of two key difference between this study and the earlier one:

- The 2006 study was intended to complement a CPR completed for BC Hydro and therefore included all residential customers of both utilities. This current study includes only those dwellings that have natural gas accounts with FortisBC.
- The 2006 study included high-rise multi-family buildings in the Residential sector, again for compatibility with the BC Hydro study. This current study includes them in the Commercial sector, to be consistent with FortisBC's customer rate classes.

Exhibit ES 2 Base Year Residential Natural Gas Consumption Distribution of Use by End Use

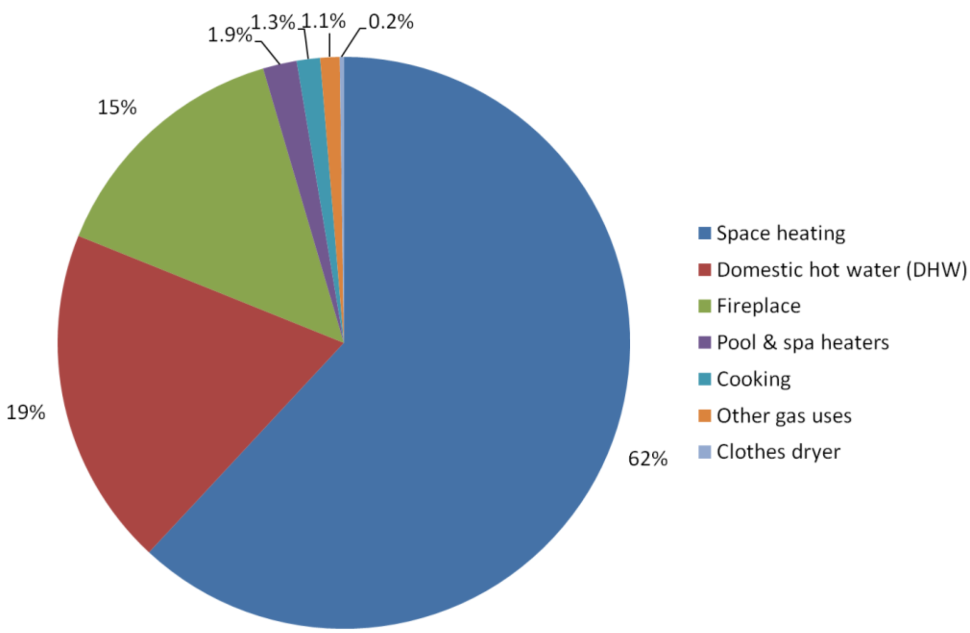
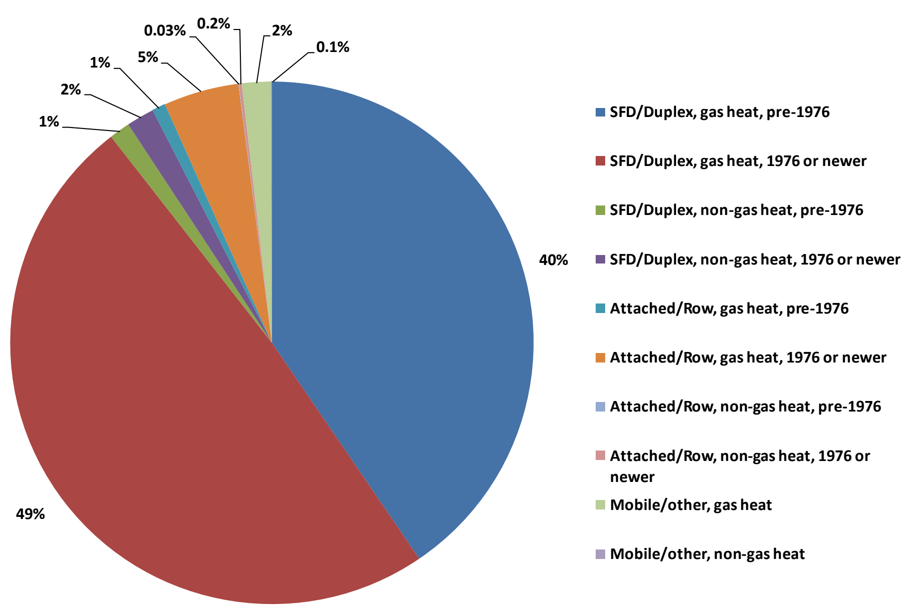


Exhibit ES 3 Base Year Residential Natural Gas Consumption Distribution of Use by Building Segment

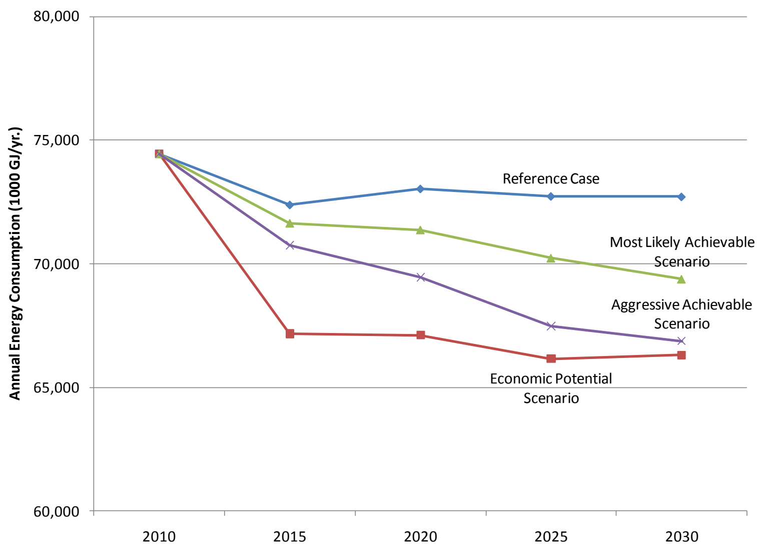


Results and Findings

A summary of the levels of annual natural gas consumption contained in the Reference Case and each of the energy-efficiency forecasts, by milestone year, is presented in Exhibit ES 4 and discussed briefly in the paragraphs below.

Exhibit ES 4 Summary of Forecast Results, Energy Efficiency (thousand GJ/yr.)

Year	Annual Consumption (thousands of GJ/yr.)					Potential Annual Savings		
	Base Year	Reference Case	Economic	Achievable		Economic	Achievable	
				Most Likely	Aggressive		Most Likely	Aggressive
2010	74,440	74,440						
2015		72,382	67,173	71,638	70,742	5,209	744	1,640
2020		73,027	67,110	71,369	69,453	5,917	1,658	3,574
2025		72,726	66,152	70,226	67,474	6,574	2,500	5,252
2030		72,707	66,306	69,378	66,871	6,401	3,329	5,836



Reference Case

In the absence of continued demand side management (DSM) initiatives, the study estimates that natural gas consumption in the Residential sector will decline from the Base Year (2010) consumption of approximately 74,440,000 GJ/yr. to 73,027,000 GJ/yr. by 2020 and 72,707,000 GJ/yr. by 2030. This represents an overall decrease of about 2% in the period. Gas consumption per customer is expected to decline over the study period, partly because of the natural replacement of furnaces and water heaters with more efficient models, as required by new mandatory minimum efficiency standards, and partly because of new minimum performance standards for the construction of new homes. The decline in consumption per customer is expected to more than compensate for the increasing number of customers over the period, so that the overall residential gas consumption will decline.

Economic Potential Forecast

Under the conditions of the Economic Potential Forecast, the study estimated that consumption in the Residential sector would decline to about 66,306,000 GJ/yr. by 2030. Annual savings relative to the Reference Case are about 6,401,000 GJ/yr., or about 9%. The Economic Potential annual savings are about 5,917,000 GJ/yr. in 2020.

Achievable Potential – Energy-efficiency Scenario

A selection of the natural gas savings opportunities identified in the Economic Potential Forecast was discussed in a full-day workshop. The guided participant discussions provided estimated levels of participation under a *most likely* scenario of program activity and an *aggressive* scenario of program activity. These levels were applied to the Economic Potential savings to estimate the Achievable Potential for these two scenarios. For technologies not specifically discussed in the workshops, participation levels were estimated through extrapolation from the technologies that were discussed. The results are presented in Exhibit ES 5 and Exhibit ES 6 by action and by milestone year.

Exhibit ES 5 Most Likely Achievable Natural Gas Savings for the Total FortisBC Service Area by Technology and Milestone Year (1000 GJ/yr.)[3]

End Use	Measure	2015	2020	2025	2030	% Savings 2030 Relative to Total 2030 Savings	Average B/C Ratio
Domestic hot water (DHW)	DHW Pipe Insulation	11	18	20	20	1%	17.08
Domestic hot water (DHW)	Showerheads	35	49	47	38	1%	9.55
Space heating	Prog. Thermostats	198	292	303	256	8%	7.05
Domestic hot water (DHW)	Faucet Aerators	21	29	28	22	1%	5.00
Fireplace	Gas Fireplaces	23	111	336	391	12%	3.45
Pool & spa heaters	Solar Pool Heaters	12	50	116	210	6%	1.25
Space heating	Wall Insulation	8	24	46	74	2%	1.17
Domestic hot water (DHW)	DHW Tank Insulation	2	4	5	5	0%	1.16
Space heating	Attic Insulation	44	85	123	159	5%	1.15
Space heating	Basement Insulation	25	71	136	217	7%	1.10
Space heating	Homeowner Air Sealing	60	116	169	218	7%	1.08
Domestic hot water (DHW)	ESTAR Clothes Washers	11	29	36	26	1%	1.02
Space heating	Early Retire Gas Furnaces	294	780	1,134	1,693	51%	0.34
Grand Total		744	1,658	2,500	3,329	100%	1.68

Exhibit ES 6 Aggressive Achievable Natural Gas Savings for the Total FortisBC Service Area by Technology and Milestone Year (1000 GJ/yr.)

End Use	Measure	2015	2020	2025	2030	% Savings 2030 Relative to Total 2030 Savings	Average B/C Ratio
Domestic hot water (DHW)	DHW Pipe Insulation	22	36	41	41	1%	17.08
Domestic hot water (DHW)	Showerheads	55	78	75	60	1%	9.55
Space heating	Prog. Thermostats	396	580	599	505	9%	7.03
Domestic hot water (DHW)	Faucet Aerators	33	46	44	35	1%	5.00
Fireplace	Gas Fireplaces	46	222	667	753	13%	3.44
Pool & spa heaters	Solar Pool Heaters	22	90	207	377	6%	1.25
Space heating	Wall Insulation	16	48	92	149	3%	1.17
Domestic hot water (DHW)	DHW Tank Insulation	5	8	10	10	0%	1.16
Space heating	Attic Insulation	88	170	247	318	5%	1.15
Space heating	Basement Insulation	49	142	272	434	7%	1.10
Space heating	Homeowner Air Sealing	120	233	338	437	7%	1.08
Domestic hot water (DHW)	ESTAR Clothes Washers	22	58	73	52	1%	1.02
Space heating	Early Retire Gas Furnaces	766	1,864	2,588	2,668	46%	0.33
Grand Total		1,640	3,574	5,252	5,836	100%	1.80

[3] Early retirement of gas furnaces is included in Exhibit ES 5 and Exhibit ES 6 at the request of FortisBC. This is because, although the measure is not considered cost effective when viewed through conventional DSM screens (it does not pass the TRC test as applied in this study), fully 76% of FortisBC's customers (or 91% of those who heat with gas furnaces) have standard- and mid-efficiency furnaces. It is the desire of FortisBC to offer its customers a program to encourage these customers to replace their standard- and mid-efficiency furnaces at or before the end of equipment life with high-efficiency furnaces. Thus, FortisBC wanted to discover through this study the impacts of such a program on the savings available from the Residential sector.

Peak Day Load Impacts – Energy-efficiency Scenarios

The peak day savings associated with each of the Achievable energy-efficiency scenarios were calculated using load factor data provided by FortisBC. The results are summarized in Exhibit ES 7 and Exhibit ES 8. As illustrated, the Achievable peak day savings in 2030 range from a decrease of about 34,000 GJ/day (*most likely* scenario) to a decrease of approximately 59,000 GJ/day (*aggressive* scenario) for the total FortisBC service region.

Exhibit ES 7 Peak Day Capacity Impacts – Most likely Achievable Potential, by Scenario, Service Region and Milestone Year (GJ)

Year	Lower Mainland	Northern Interior	Southern Interior	Vancouver Island	Whistler	Grand Total
2015	5,294	1,224	747	256	17	7,539
2020	11,830	2,670	1,695	575	29	16,800
2025	17,913	3,840	2,543	995	28	25,319
2030	23,904	5,182	3,398	1,215	25	33,724
Savings 2030 Relative to Total 2030 Savings	71%	15%	10%	4%	0.1%	100%

Exhibit ES 8 Peak Day Capacity Impacts – Aggressive Achievable Potential, by Scenario, Service Region and Milestone Year (GJ)

Year	Lower Mainland	Northern Interior	Southern Interior	Vancouver Island	Whistler	Grand Total
2015	11,686	2,683	1,676	530	39	16,614
2020	25,557	5,711	3,705	1,181	60	36,214
2025	37,702	8,034	5,410	1,997	54	53,196
2030	41,351	9,632	5,890	2,205	47	59,126
Savings 2030 Relative to Total 2030 Savings	70%	16%	10%	4%	0.1%	100%

Electricity Impacts

The natural gas savings associated with the Economic Potential scenario shown in Exhibit ES 4 would also result in "collateral" electricity savings as some efficiency measures affect both energy sources. The study estimated that in 2030 the natural gas efficiency measures contained in the Economic Potential scenario would result in additional electrical savings of 24 GWh/yr.

Greenhouse Gas Impacts – Energy-efficiency Scenarios

The natural gas savings associated with each of the Achievable energy-efficiency scenarios shown in Exhibit ES 5 and Exhibit ES 6 would result in significant greenhouse gas reductions. The study estimated that in 2030 the natural gas efficiency measures contained in the *aggressive* and *most likely* Achievable Potential scenarios would reduce greenhouse gas emissions by, respectively, 296,000 and 169,000 of CO_2e/yr. The electricity savings associated with the natural gas efficiency measures would result in additional GHG reductions, which have not been included in this calculation.

Exhibit ES 9 Estimated GHG Emission Reductions – Most Likely Achievable Potential, By Scenario and Milestone Year (tonnes CO_2e/yr.)

Year	Lower Mainland	Northern Interior	Southern Interior	Vancouver Island	Whistler	Grand Total
2015	26,603	6,032	3,681	1,322	85	37,724
2020	59,447	13,156	8,352	2,966	146	84,067
2025	90,014	18,917	12,530	5,139	138	126,737
2030	120,118	25,530	16,741	6,270	126	168,785
Savings 2030 Relative to Total 2030 Savings	71%	15%	10%	4%	0.1%	100%

Exhibit ES 10 Estimated GHG Emission Reductions – Aggressive Achievable Potential, By Scenario and Milestone Year (tonnes CO_2e/yr.)

Year	Lower Mainland	Northern Interior	Southern Interior	Vancouver Island	Whistler	Grand Total
2015	58,723	13,220	8,255	2,738	192	83,129
2020	128,426	28,136	18,252	6,096	301	181,211
2025	189,455	39,580	26,653	10,307	268	266,263
2030	207,792	47,455	29,016	11,384	236	295,883
Savings 2030 Relative to Total 2030 Savings	70%	16%	10%	4%	0.1%	100%

Achievable Potential - Customer Behaviour

The study also assessed potential from customer behaviours changes. Exhibit ES 11 presents a summary of the results for both the aggressive and most likely achievable potential scenarios.

It should be noted that there is significant potential overlap with the reported savings from energy efficiency technologies. Consequently, the behaviour savings shown in Exhibit ES 11 have not been added to those for the energy efficiency technologies.

Exhibit ES 11 Achievable Potential from Customer Behaviour Changes, Aggressive and Most Likely Achievable Natural Gas Savings, by Milestone Year (1000 GJ/yr.)

Scenario		Energy Impact (1000 GJ/yr.)			
		2015	2020	2025	2030
Residential	Most Likely	383	975	1,727	2,649
	Aggressive	199	518	930	1,439

Table of Contents

APPENDICES (Bound Separately)

List of Exhibits

1 Introduction

1.1 Background and Objectives

This Conservation Potential Review (CPR) provides FortisBC with a comprehensive planning document that the company can use on an ongoing basis to:

- Develop a long-range energy-efficiency strategy
- Design and implement energy-efficiency programs
- Assess the impact of energy-efficiency programs on both peak and annual load
- Set annual energy-efficiency targets and budgets.

1.2 Study Scope

Sector Coverage: The study addresses three sectors: Residential, Commercial/Institutional[4] and Industrial. In contrast to the 2006 CPR, which excluded FortisBC's 300 largest manufacturing accounts, this CPR includes all of FortisBC's customers.

Geographical Coverage: The study results are presented for the total FortisBC service region and for the five service areas of: Lower Mainland, Vancouver Island, Whistler, Northern Inland and Southern Inland.

Study Period: The Base Year for this study is calendar year 2010. The time period covered by this study is to 2030, with milestones at the intervening years of 2015, 2020 and 2025.

Technologies: The study addresses energy-efficiency, customer behaviour and alternative energy options such as renewables and combined heat and power technologies.

Relation to Previous B.C. CPRs: This study builds on the substantial body of information and modelling work prepared in previous CPR studies conducted for FortisBC (then Terasen Gas) (2006) and BC Hydro (2007). The 2006 FortisBC study was intended to mesh with the BC Hydro study from 2007 and therefore included all customers of either utility, not just FortisBC customers. This study includes only FortisBC natural gas customers because this permitted the study to make better use of the recently completed energy end use studies.

1.2.1 *Data Caveat*

As in any study of this type, the results presented in this report are based on a large number of important assumptions. Assumptions such as those related to the current penetration of energy-efficient technologies, the rate of future growth in the stock of residential buildings and customer willingness to implement new energy-efficiency measures are particularly influential. Wherever possible, the assumptions used in this study are consistent with those used by FortisBC and are based on best available information, which in many cases includes the professional judgement of the consultant team, FortisBC personnel and local experts. The reader should, therefore, use the results presented in this report as best available estimates; major assumptions, information sources and caveats are noted throughout the report.

[4] Throughout this report, use of the word "commercial" includes both commercial and institutional buildings unless otherwise noted.

1.3 Study Organization

The study has been organized into four[5] areas:

- **Three individual sector reports** (Residential, Commercial and Industrial) that provide an assessment of the technical opportunities for more efficient use of natural gas within each sector. A summary report will bring together the findings of all three sectors.
- **A commercial end-use survey (CEUS)** that provides insight into current natural gas equipment efficiency levels, fuel share and annual consumption levels within key commercial sub sectors. The CEUS results were used to refine the Commercial sector building archetypes employed in the assessment of technical opportunities.
- **A summary and employment impact report** that brings together the findings of the Residential, Commercial and Industrial sectors, together with an estimate of the net job creation and other economic effects attributable to the Achievable efficiency results within the three sectors.
- **An options paper** that outlines alternative approaches to the assessment of cost-effective levels of DSM activity outside of the California Standard Practice tests.

1.4 This Report

This report presents the Residential sector results and is organized as follows:

- **Section 2** presents an overview of the study methodology, including a definition of key terms and an outline of the major analytic steps involved.
- **Section 3** presents a profile of Residential sector Base Year natural gas use in the total FortisBC service area as well as in the five individual service regions.
- **Section 4** presents the Residential sector Reference Case, which provides a detailed estimate of natural gas use within the total FortisBC service area and each of the five service regions over the study period 2010 to 2030, in the absence of new DSM program initiatives.
- **Section 5** identifies and assesses the economic attractiveness of energy-efficiency, customer behaviour and alternative energy technology options within the Residential sector.
- **Section 6** presents the Residential sector Economic Potential Forecast for the study period 2010 to 2030.
- **Section 7** estimates the proportion of energy savings identified in the Economic Potential Forecast that can realistically be achieved within the study period. Impacts on peak day loads and greenhouse gas emissions are also presented.
- **Section 8** summarizes the key study findings and identifies areas that warrant further consideration.
- **Section 9** lists sources and references.

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[5] A separate Customer Preferences study was prepared in parallel with this CPR. The two studies were, however, implemented in a co-ordinated manner and the results of the Customer Preferences study contributed to the results of this CPR.

- **Section 10** provides a glossary of terms.

1.5 Results Presentation

The preparation of Conservation Potential Reviews involves the compilation and analysis of an enormous amount of market and technology data and a nearly infinite number of ways of organizing and presenting the results. It is recognized that readers will have differing levels of needs with respect to the level of detail that is provided. Consequently, the results of this CPR study are presented at three levels of detail.

- **Main report body**. The main body of the report provides a relatively high level reporting of the main steps involved in undertaking each stage of the study together with a concise summary of results, including comments and interpretation of key findings. It is assumed that the content and level of detail in the main report body is suitable for the majority of readers who wish to gain an understanding of the potential contribution of DSM options to FortisBC's long-term natural gas requirements.

- **Appendices.** A separate appendix accompanies each major chapter of the main report. Each appendix provides more detailed information on the methodology employed, including major assumptions or sample calculations as applicable, together with additional levels of results. It is assumed that this presentation is better suited to DSM analysts and managers wishing a more thorough understanding of the study results.

- **Software.** All of the data generated by the study is provided in two custom-designed Excel models: Data Manager and the Measure TRC model.

    - Data Manager is a custom designed Excel workbook with query protocols that enable the user to search and report the study results in a virtually infinite number of combinations. Data Manager is intended to support the most detailed level of DSM activity such as program design, preparation of regulatory submissions, etc.

    - The Measure TRC model is a custom designed model that provides comprehensive profiles of the DSM measures assessed within the study. Because the information is provided in software form, any changes to economic, financial or performance data inputs can be easily accommodated and revised results generated automatically.

2 Study Methodology

This section provides an overview of the methodology employed for this study. More specifically, it addresses:

- Definition of terms
- Major analytic steps
- Key economic inputs
- Analytic models.

2.1 Definition of Terms

This study employs numerous terms that are unique to analyses such as this one and consequently it is important to ensure that all readers have a clear understanding of what each term means when applied to this study. Below is a brief description of some of the most important terms.

Base Year The Base Year is the starting point for the analysis. It provides a detailed description of "where" and "how" energy is currently used in the existing Residential sector building stock. Creation of the Base Year required the development of profiles of natural gas use within each dwelling type and service region.

Reference Case (includes Natural Conservation) The Reference Case estimates the expected level of natural gas consumption that would occur over the study period in the absence of new DSM program initiatives. It provides the point of comparison for the subsequent calculation of "economic" and "achievable" savings potentials. Creation of the Reference Case required the development of detailed profiles for new buildings in each of the building segments, estimation of the expected growth in building stock, estimation of the likely impacts of new building and appliance standards, and, finally, an estimation of "natural" changes affecting energy consumption over the study period.

Technology Assessment Energy-efficiency, customer behaviour and alternative energy options were identified that met the criteria, as outlined in Section 1.2. Technology cost and performance data were compiled relative to the baseline technology and the measure total resource cost (TRC) was calculated for each option.

The measure TRC calculates the net present value of energy savings that result from an investment in an efficiency, behaviour or alternative energy technology or measure. The measure TRC is equal to its full or incremental capital cost (depending on application) plus any change (positive or negative) in the combined annual energy and operating and maintenance (O&M) costs. This calculation includes, among others, the following inputs: the avoided natural gas and electricity supply costs, the life of the technology, and the selected discount rate, which for this analysis has been set at 7.38% for most of the regions and 6.87% for Vancouver Island.

Economic Potential Forecasts

The Economic Potential Forecast is the level of energy consumption that would occur if all equipment and building envelopes were upgraded to the level that is cost effective, from FortisBC's perspective, when using lifecycle costing with the long-run avoided cost of new natural gas supply. All the energy-efficiency, behaviour and alternative energy options included in the technology assessment that had a positive measure TRC were incorporated into the Economic Potential Forecast.

Two Economic Potential Forecasts were prepared: 1) energy efficiency and alternative energy and 2) behaviour.

Achievable Potential

The Achievable Potential is the proportion of the savings identified in the Economic Potential Forecast that could realistically be achieved within the study period. Achievable Potential recognizes that it is difficult to induce customers to purchase and install all the energy-efficiency/alternative energy or behaviour options that meet the criteria defined by the Economic Potential Forecast. The results are presented as a range, defined as *most likely* and *aggressive*.

Estimates provided were developed in a workshop involving FortisBC energy-efficiency program personnel, trade allies, selected external experts and the consulting team.

Peak Day Load Impacts

Load factors provided by FortisBC were used to derive peak day load impacts from the energy consumption values contained in each of the potential estimates noted above.

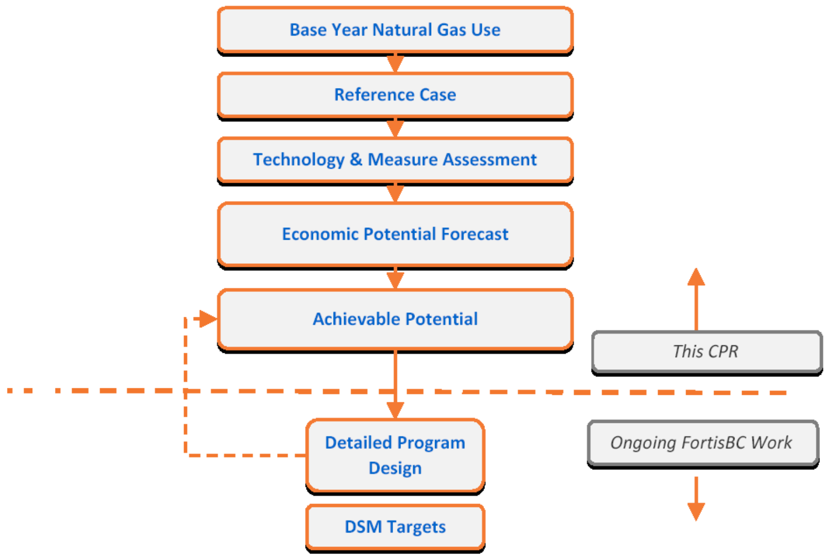
Residential Customers

For the purpose of this study, residential customers are those categorized under Rate 1 in most of the FortisBC service area, RGS in the Vancouver Island region, and Res SGS1/SGS2 in the Whistler Region. Multi-storey apartment and strata buildings are addressed in the Commercial sector report.

2.2 Overview of Approach

To meet the objectives outlined above, the study was conducted within an iterative process that involved a number of well-defined steps, as outlined in Exhibit 1. At the completion of each step, the client reviewed the results and, as applicable, revisions were identified and incorporated into the interim results. The study then progressed to the next step.

Exhibit 1 CPR 2010: Main Analytic Steps



A summary of the steps is presented below.

Step 1: Develop Base Year Calibration Using Actual FortisBC Billing Data

- Compile and analyze available data on British Columbia's existing building stock.
- Develop detailed technical descriptions of the existing building stock.
- Undertake computer simulations of energy use in each building type and compare these with actual building billing and audit data.
- Compile actual FortisBC billing data.
- Create sector model inputs and generate results.
- Calibrate sector model results using actual billing data.

Step 2: Develop Reference Case

- Compile and analyze building design, equipment and operations data and develop detailed technical descriptions of the new building stock.
- Develop computer simulations of energy use in each new building type.
- Compile data on forecast levels of building stock growth and "natural" changes in equipment efficiency levels and/or practices.
- Define sector model inputs and create forecasts of energy use for each of the milestone years.
- Calibrate with FortisBC load forecast.

Step 3: Develop and Assess Energy-efficiency, Alternative Energy, and Behaviour Options

- Develop list of energy-efficiency, alternative energy, and behaviour measures.
- Compile detailed cost and performance data for each measure.
- Identify the baseline technologies employed in the Reference Case.
- Develop energy-efficiency, alternative energy, and behaviour options for each end use.
- Compile FortisBC and BC Hydro economic data on current and forecast costs for new supply of natural gas and electricity generation.

- Determine the measure TRC for each energy-efficiency, alternative energy, or behaviour option.

Step 4: Estimate Economic Energy-efficiency and Alternative Energy Potential

- Screen the identified energy-efficiency and alternative energy measures from Step 3 against the economic data.
- Identify the combinations of energy-efficiency measures and building types where the measure TRC is positive.
- Apply the economically attractive energy-efficiency measures from Step 3 within the energy use simulation model developed previously for each building type.
- Determine annual natural gas consumption in each building type when the economic efficiency measures are employed.
- Compare the consumption levels when all economic efficiency measures are used with the Reference Case consumption levels and calculate the natural gas consumption impacts.

Step 5: Estimate Economic Customer Behaviour Potential

- Apply the customer behaviour measures from Step 3 within the energy use simulation model developed previously for each building type.
- Compare the consumption levels when all economic behaviour measures are used with the Reference Case consumption levels and calculate the natural gas consumption impacts.

Step 6: Estimate Achievable Savings Potential

- "Bundle" the energy-efficiency, alternative energy and customer behaviour options identified in the Economic Potential Forecast into a set of Actions.
- Create "Action Profiles" for each of the identified Actions that provide a high level rationale and direction, including target technologies and sub markets as well as key barriers and a broad intervention strategy.
- Review historical Achievable program results and prepare preliminary Action Assessment Worksheets.
- Consult with FortisBC personnel, review preliminary estimates and reach general agreement on *most likely* and *aggressive* range of Achievable Potential.

Step 7: Estimate Peak Day Load Impacts of Economic and Achievable Savings Potential

- Annual energy decreases/increases contained in each of the energy-efficiency/alternative energy scenarios were converted to average daily values based on annual load profile data provided by FortisBC.
- Load factors that correlate "average" to "peak" consumption were provided by FortisBC for each rate class and service region.
- Peak day load impacts were calculated for each of the energy-efficiency/alternative energy scenario results by applying the above load factors.

2.3 Analytical Models

The analysis of the Residential sector employs three modelling platforms. They are:

- HOT2000**,** a commercially supported, residential building simulation software.
- RSEEM (***R***esidential ***S***ector ***E***nergy ***E***nd-use ***M***odel), a Marbek in-house spreadsheet-based macro model.
- RETScreen, a commercially supported, renewable energy systems modelling tool.

HOT2000 is used to define household heating, cooling and domestic hot water (DHW) energy use for each of the residential building archetypes. HOT2000 uses state-of-the-art heat loss/gain and system modelling algorithms to calculate household energy use. It addresses:

- Electric, natural gas, oil, propane and wood space heating systems and DHW systems.
- Space heating and DHW systems from conventional to high-efficiency condensing systems.
- Air, ground and water source heat pumps.
- Central air conditioning systems with conventional or economizer controls.
- Primary and secondary DHW systems, including solar DHW.
- Inputs of steady state or seasonal efficiencies for heating and cooling equipment.

The outputs from HOT2000 provide the space heating/cooling energy-use intensity (EUI) inputs to the thermal archetype module of RSEEM (see below).

RSEEM is a spreadsheet-based macro model that has been used in many studies similar to this current one. RSEEM consists of three modules:

- A general parameters module that contains general sector data (e.g., number of dwellings, growth rates, etc.).
- A thermal archetype module, as noted above, that contains data on the heating and cooling loads in each archetype.
- An appliance module that contains data on appliance saturation levels, fuel shares, unit energy use, etc.

RSEEM combines the data from each of the modules and provides total natural gas use by dwelling type and end use for each of the target years.

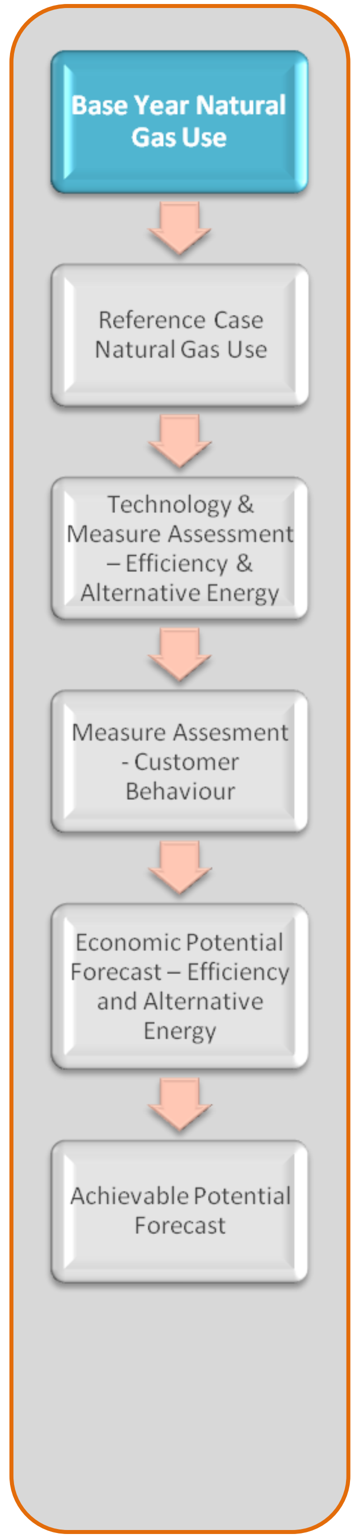
RETScreen is a modelling tool developed and maintained by Natural Resources Canada specifically for analyzing renewable and alternative energy systems such as those addressed by this study. Renewable and alternative energy analysis modules supported by the software are summarised in Exhibit 2.

Exhibit 2 RETScreen Renewable/Alternative Energy Modules

Power	Heating	Cooling
Fuel cell	Biomass system	Absorption
Gas turbine - combined cycle	Heat pump	Desiccant
Geothermal power	Passive solar heating	Free cooling
Hydro turbine	Solar air heater	Heat pump
Ocean current power	Solar water heater	Other
Photovoltaic		
Reciprocating engine CHP		
Solar thermal power		
Steam turbine		
Tidal/wave power		
Wind turbine		

RETScreen also contains energy-efficiency modules.

3 Base Year (2010) Natural Gas Use



This section provides a profile of Base Year (2010) natural gas use in B.C.'s Residential sector. The discussion is organized into the following sub sections:

- Base Year housing stock
- Natural gas end uses
- Net space heating loads
- Annual appliance unit energy use (UEC)
- Average natural gas use per dwelling unit
- Summary of model results.

Each of the above is discussed below. Additional information is provided in Appendix A.

3.1 Base Year Housing Stock

The first step in developing the profile of Base Year natural gas consumption involved the segmentation of the residential building stock on the basis of four factors:

- Dwelling type
- Vintage
- Heating category (natural gas, electric)
- Service region.

Based on discussions with FortisBC personnel, it was agreed that B.C.'s existing residential stock would be segmented into the following dwelling types:

- Single detached/duplex Gas- pre 1976[6]
- Single detached/duplex Gas - post 1976
- Single detached/duplex Non-Gas - pre 1976
- Single detached/duplex Non-Gas - post 1976
- Attached/row housing Gas – pre 1976
- Attached/row housing Gas – post 1976
- Attached/row housing Non-Gas – pre 1976
- Attached/row housing Non-Gas – post 1976
- Mobile/other with gas heat
- Mobile/other without gas heat.

FortisBC customer billing data, combined with data from the 2008 Residential End Use Study (REUS) prepared for FortisBC were used to develop a composite breakdown of the Residential sector.

A summary of the distribution of B.C.'s residential dwellings is provided in Exhibit 3, by dwelling type, primary heating source and service region.

[6] 1976 was chosen as a dividing year largely to be consistent with previous studies and to draw on earlier research. In the earlier studies, 1976 was chosen because there was a change in the building standards at the time that affected space heating consumption in new homes built after that date.

Exhibit 3 Existing Residential Units, by Dwelling Type, Primary Heating Source and Service Region

Dwelling Units	Lower Mainland	Vancouver Island	Southern Interior	Northern Interior	Whistler	Grand Total	% of Total
SFD/Duplex, gas heat, pre-1976	195,502	24,278	42,485	24,070	99	286,436	34%
SFD/Duplex, gas heat, 1976 or newer	241,378	33,784	81,743	46,311	911	404,127	47%
SFD/Duplex, non-gas heat, pre-1976	12,700	10,159	3,198	1,812	48	27,916	3%
SFD/Duplex, non-gas heat, 1976 or newer	15,681	14,136	6,153	3,486	437	39,892	5%
Attached/Row, gas heat, pre-1976	7,115	597	760	431	16	8,919	1%
Attached/Row, gas heat, 1976 or newer	42,401	4,017	6,210	3,518	503	56,649	7%
Attached/Row, non-gas heat, pre-1976	462	250	57	32	8	809	0%
Attached/Row, non-gas heat, 1976 or newer	2,754	1,681	467	265	241	5,409	1%
Mobile/other, gas heat	9,508	1,427	6,574	3,724	15	21,248	2%
Mobile/other, non-gas heat	618	597	495	280	7	1,997	0%
Grand Total	528,119	90,926	148,143	83,930	2,285	853,403	100%
% of Total	62%	11%	17%	10%	0%	100%	

As illustrated in Exhibit 3:

- Nearly 62% of FortisBC residential customers are located in the Lower Mainland region. The second largest region is Inland Southern, with 17% of FortisBC customers.
- Nearly 89% of FortisBC residential customers are in the single detached or duplex category.
- Nearly 91% of FortisBC customers use natural gas as their primary space heating fuel. Natural space heating shares on Vancouver Island (~70%) are lower than in other regions served by FortisBC.

3.2 Natural Gas End Uses

Natural gas use within each of the dwelling types noted above is defined on the basis of specific end uses. In this study, an end use is defined as, "the final application or final use to which energy is applied. End uses are the services of economic value to the users of energy."

A summary of the major Residential sector end uses used in this study is provided in Exhibit 4, together with a brief description of each. As noted in Exhibit 3, several of the end uses included in this study use electricity. They are included in this study because their consumption levels can be affected by some of the natural gas efficiency measures. For example, added insulation reduces winter space heating consumption (natural gas) but it also reduces summer air conditioning loads (electricity). This analysis captures these changes, known as interactive effects.

Exhibit 4 Residential End Uses

End Use	Description
Space heating	All space heating, including both central heating and supplementary heating
Domestic hot water (DHW)	Heating of water for domestic hot water (DHW) use. Does not include hydronic space heating
Fireplaces	
Cooking appliances	Includes ranges, separate ovens and cook tops and microwave ovens
Clothes dryers	
Swimming pool and spa heaters	
Other	Barbeques, outdoor fire places and lighting
Related Electric End Uses	
Ventilation & circulation	Primarily the furnace fan, but also includes the fan in heat recovery ventilators as well as kitchen and bathroom fans
Space cooling	All space cooling, including both central air conditioning (AC) and room or portable AC
Clothes washer	
Dishwasher	
Other electric internal loads	Lighting, electronics, appliances, etc.

Further discussion of natural gas use within each of the above end uses is provided below.

3.2.1 *Annual Space Heating Loads, by Dwelling Type and Service Region*

The next step involved estimating the net space heating loads[7] for each of the dwelling types and service regions noted above. Estimation of the net space heating loads involved the consideration of numerous factors such as envelope area and exposure, floor area, regional climate, insulation and air tightness levels, basement style, etc.

Exhibit 5 provides a summary of the net space heating load by dwelling type, vintage and service region. A detailed description of the data sources and approach used to estimate the levels shown in Exhibit 5 is provided in Appendix A.

Exhibit 5 Existing Residential Dwellings—Net Space Heating Loads by Building Type, Vintage and Service Region, (MJ/yr.)

Dwelling Types	Lower Mainland	Vancouver Island	Southern Interior	Northern Interior	Whistler	Weighted Average
SFD/Duplex, gas heat, pre-1976	68,946	46,066	48,002	89,990	88,031	65,675
SFD/Duplex, gas heat, 1976 or newer	55,557	37,620	40,602	76,117	74,460	53,431
SFD/Duplex, non-gas heat, pre-1976	65,056	45,344	47,410	88,881	86,946	57,445
SFD/Duplex, non-gas heat, 1976 or newer	52,422	37,031	40,101	75,179	73,543	47,287
Attached/Row, gas heat, pre-1976	38,660	25,071	28,693	53,791	52,620	37,657
Attached/Row, gas heat, 1976 or newer	31,392	20,488	25,415	47,646	46,608	31,108
Attached/Row, non-gas heat, pre-1976	28,847	19,325	23,486	44,030	43,071	26,275
Attached/Row, non-gas heat, 1976 or newer	23,424	15,792	20,803	39,000	38,151	22,245
Mobile/other, gas heat	35,642	24,267	31,784	59,587	58,290	37,897
Mobile/other, non-gas heat	35,645	24,269	31,787	59,592	58,295	34,728
Weighted Average	57,908	39,056	41,663	78,106	64,753	55,084

Key observations from Exhibit 5 are as follows:

[7] Net space heating load is the space heating load of a building that must be met by the space heating system. This is equal to the total heat loss through the building envelope minus solar and internal gains. The heating load is assumed to be met by a natural gas heating system with an efficiency similar to the average efficiency in the FortisBC service area.

- The regional variation is considerable. Since space heating dominates natural gas consumption, the assumed net heating load for a set of dwellings is strongly influenced by the average sales of gas to those homes. Although the climates of the Vancouver Island and Lower Mainland regions are similar, the sales of gas per dwelling on Vancouver Island are much lower, and the assumed net space heating load for that region has been adjusted to reflect this. It is assumed that a combination of dwelling size, building envelope quality, and behaviour explains the difference. Dwellings in the Southern Interior also have much lower net space heating loads than dwellings in the Lower Mainland, even though the climate is somewhat colder. Again, this is assumed to occur because of differences in dwelling size, building envelope quality, and behaviour. Dwellings in the Northern Interior and Whistler regions have higher net space heating loads, mainly due to colder climate.
- Newer dwellings are assumed to have lower net space heating loads than older dwellings, mainly because of better building envelopes.
- Attached dwellings are assumed to have lower net space heating loads than detached dwellings, primarily because they are somewhat smaller and share common walls. Mobile homes also are assumed to have lower net space heating loads, mainly due to smaller size.
- The net space heating loads for dwellings not heated by gas are assumed to be somewhat lower than those for gas-heated homes. This is due to a combination of smaller size, better building envelope, and occupant behaviour.[8]

3.2.2 *Annual Appliance Unit Energy Use (UEC)*

The next step involved estimating the average annual unit energy consumption (UEC) for major natural gas end-use appliances other than space heating equipment. UEC is the average consumption for a given end use for dwellings of a given type in a given region that *have the end use and use natural gas for it*. The number may be reduced by a saturation less than 100% or a natural gas fuel share less than 100% (or both).

Exhibit 6 provides the estimated UEC values for the Lower Mainland region. The values shown in Exhibit 6 apply to the current stock mix in the Lower Mainland. UECs vary slightly by service region, in some cases because of climate, in other cases because of differences in occupancy rates, and in some cases because of some combination of influences. For some end uses, consumption was assumed to vary between detached and attached houses, mainly because of differences in occupancy. Where no information on variation was available, identical UECs were used for different groups of houses.

Further discussion of the estimated UEC values is provided in Appendix A, together with the UECs for the other service regions.

[8] Habart & Associates, *Energy Use Discrepancy Analysis*, prepared for FortisBC, April 2010.

Exhibit 6 Annual Appliance Natural Gas Use (UEC) for the Lower Mainland in Base Year (MJ/yr.)

Dwelling Types	Domestic hot water (DHW)	Fireplace	Cooking	Clothes dryer	Pool & spa heaters	Other gas uses
SFD/Duplex, gas heat, pre-1976	21,061	25,833	5,694	4,607	27,693	1,093
SFD/Duplex, gas heat, 1976 or newer	21,061	25,833	5,694	4,607	27,693	1,093
SFD/Duplex, non-gas heat, pre-1976	21,061	25,833	5,694	4,607	27,693	1,093
SFD/Duplex, non-gas heat, 1976 or newer	21,061	25,833	5,694	4,607	27,693	1,093
Attached/Row, gas heat, pre-1976	18,750	15,709	5,079	4,102	27,693	973
Attached/Row, gas heat, 1976 or newer	18,750	15,709	5,079	4,102	27,693	973
Attached/Row, non-gas heat, pre-1976	18,750	15,709	5,079	4,102	27,693	973
Attached/Row, non-gas heat, 1976 or newer	18,750	15,709	5,079	4,102	27,693	973
Mobile/other, gas heat	18,369	15,389	4,962	4,007	27,693	953
Mobile/other, non-gas heat	18,369	15,389	4,962	4,007	27,693	953

3.3 Average Natural Gas Consumption Per Dwelling Unit

Exhibit 7 provides a profile of average natural gas use within each of the dwelling types and end uses described above for dwellings in the Lower Mainland. The values shown in Exhibit 7 combine three factors:

- **Unit Energy Consumption (UEC).** This is the average amount of natural gas that one appliance (e.g., a hot water tank) consumes annually in a given dwelling type.
- **Saturation.** This is the percentage of households within each dwelling type that have the given appliance. For example, in the case of a hot water tank, every household has one and, therefore, the saturation is 100%. However, some appliances such as dryers or fireplaces have a saturation of less than 100% as some households do not have these appliances.
- **Natural Gas Fuel Share.** Several appliances, such as hot water tanks, clothes dryers, cooking ranges, etc., can operate on natural gas or electricity as well as other fuels. Natural gas fuel share, therefore, refers to the percentage of each appliance that operates with natural gas.

A sample calculation is provided below for DHW use in pre-1976 single detached homes. The exhibits cited below are contained in Appendix A. Appendix A also presents the results for the remaining service regions, together with a detailed discussion of the estimation of UEC, saturation and natural gas fuel data.

Sample Calculation of Annual DHW Natural Gas Consumption for a SFD/Duplex, Gas-heated – pre-1976 home In Lower Mainland Region

UEC, see Exhibit 6	21,061 MJ/yr.
Saturation, see Exhibit A 13	100%
Natural Gas Fuel Share, see Exhibit A 18	92.3%

Annual DHW Natural Gas Consumption = 21,061 x 100% x 92.3% = 19,439 MJ/yr.

Exhibit 7 Average Natural Gas Use per Dwelling Unit for the Lower Mainland, Base Year (MJ/yr.)

Dwelling Types	Space heating	Domestic hot water (DHW)	Fireplace	Cooking	Clothes dryer	Pool & spa heaters	Other gas uses	Grand Total
SFD/Duplex, gas heat, pre-1976	76,679	19,439	14,654	1,344	238	2,056	1,093	115,504
SFD/Duplex, gas heat, 1976 or newer	61,787	19,439	14,654	1,344	238	2,056	1,093	100,612
SFD/Duplex, non-gas heat, pre-1976	3,699	14,598	14,654	1,344	238	2,056	1,093	37,683
SFD/Duplex, non-gas heat, 1976 or newer	2,980	14,598	14,654	1,344	238	2,056	1,093	36,965
Attached/Row, gas heat, pre-1976	42,996	17,189	10,478	890	132	592	973	73,250
Attached/Row, gas heat, 1976 or newer	34,913	17,189	10,478	890	132	592	973	65,167
Attached/Row, non-gas heat, pre-1976	2,788	12,909	10,478	890	132	592	973	28,762
Attached/Row, non-gas heat, 1976 or newer	2,264	12,909	10,478	890	132	592	973	28,238
Mobile/other, gas heat	39,639	16,954	7,999	1,140	197	592	953	67,475
Mobile/other, non-gas heat	2,027	12,732	7,999	1,140	197	592	953	25,640
Weighted Average	60,916	18,876	14,110	1,295	227	1,882	1,078	98,383

3.4 Summary of Residential Base Year Natural Gas Use

This section combines the data on average annual natural gas use by dwelling type shown in the preceding exhibit with data on the number of each dwelling type to produce a summary of the total natural gas use in B.C.'s Residential sector in the Base Year (2010). The model results shown in Exhibit 8 are within 1% of FortisBC's actual reported sales volume.

The results are presented for the Total FortisBC Service Area and for the Lower Mainland. Results for the remaining service regions are provided in Appendix A.

- Exhibit 8 presents the natural gas consumption by dwelling type and end use for the total FortisBC service area, with a pie chart that shows the end use breakdown
- Exhibit 9 presents the same information for the Lower Mainland region
- Exhibit 10 shows the relationship of % of dwelling units to % of Base Year consumption. The dwellings that account for less than 2% of units and consumption are not labelled on the chart.

Additional highlights are provided below.

By Dwelling Type

- Approximately 92% of the natural gas FortisBC supplies to residential customers (not including multi-family high rises[9]) is consumed in single detached or duplex dwellings.
- Approximately 6% is consumed in attached dwellings, while the remaining 2% is consumed in mobile homes.
- The main reason why consumption by dwelling type is dominated by detached dwellings is that they make up 89% of the residential dwellings in the FortisBC service area. Their consumption is more than 89% of the total because their saturations of end uses such as pools is higher than in attached or mobile dwellings. They are also less likely to have electric heat or DHW than attached or mobile dwellings.

[9] For the purposes of this study, residential customers are those categorized under Rate 1 in most of the FortisBC service area, RGS in the Vancouver Island region, and Res SGS1/SGS2 in the Whistler Region. Multi-storey apartment and strata buildings are addressed in the Commercial sector report.

By End Use

- Approximately 63% of the natural gas FortisBC supplies to residential customers is used for space heating.
- Approximately 19% is used for heating water.
- Approximately 13% is used in natural gas fireplaces.
- Pools and spas, cooking, clothes dryers, and all other uses together account for approximately 5% of residential natural gas consumption.

By Service Region

- Customers in the Lower Mainland region consume approximately 70% of the natural gas FortisBC supplies to residential customers.
- Customers in the Inland Southern and Inland Northern regions consume 12% and 11% of the residential natural gas, respectively.
- Customers in the Vancouver Island region consume 7% of the residential natural gas, and customers in Whistler consume less than 1%.

Data Manager – Final Edition

As part of the final report, a final version of Data Manager is also provided. This Excel workbook includes all the exhibits that were produced using Excel for Chapters 3, 4, 7, 8, and the Appendices of the document. It also has the ability to produce charts and tables looking at the data filtered and segmented in other ways. For example:

- The user can produce a pie chart of natural gas consumption by end use for an individual dwelling type of interest, such as the SFD/Duplex pre-1976.

- The user can produce a column chart showing the natural gas consumption for dryers and fireplaces in each of several dwelling types, with each dwelling type as a separate column and the different appliance consumption values shown stacked on top of each other.

- The user can produce a table of the savings for a specific measure such as basement insulation, showing which dwelling types and regions offer the most savings in a given scenario.

- The user can produced a line chart showing consumption in a given region by year for each scenario.

This version of the Data Manager includes all the data from previous versions, with any revisions and corrections as applicable.

Data Manager has a user interface designed for someone with basic knowledge of Excel. Contact Marbek if you need any help to get started with it.

Exhibit 8 Natural Gas Consumption for the Total FortisBC Service Area, Modelled by End Use and Dwelling Type, Base Year (1000 GJ/yr.)

Dwelling Types	Space heating	Domestic hot water (DHW)	Fireplace	Pool & spa heaters	Cooking	Other gas uses	Clothes dryer	Grand Total	% of Total
SFD/Duplex, gas heat, pre-1976	20,316	5,059	3,560	478	347	286	76	30,122	40%
SFD/Duplex, gas heat, 1976 or newer	23,172	6,940	4,740	641	472	392	108	36,465	49%
SFD/Duplex, non-gas heat, pre-1976	182	339	332	35	34	27	9	958	1%
SFD/Duplex, non-gas heat, 1976 or newer	208	470	455	48	47	39	13	1,281	2%
Attached/Row, gas heat, pre-1976	366	143	85	5	7	8	1	616	1%
Attached/Row, gas heat, 1976 or newer	1,914	893	527	29	47	52	8	3,470	5%
Attached/Row, non-gas heat, pre-1976	3	9	7	0	1	1	0	21	0%
Attached/Row, non-gas heat, 1976 or newer	14	58	48	2	5	5	1	132	0%
Mobile/other, gas heat	854	304	124	9	20	17	5	1,332	2%
Mobile/other, non-gas heat	6	20	12	1	2	2	1	43	0%
Total	47,036	14,234	9,890	1,247	980	828	224	74,440	100%
% of Total	63%	19%	13%	2%	1%	1%	0%	100%	

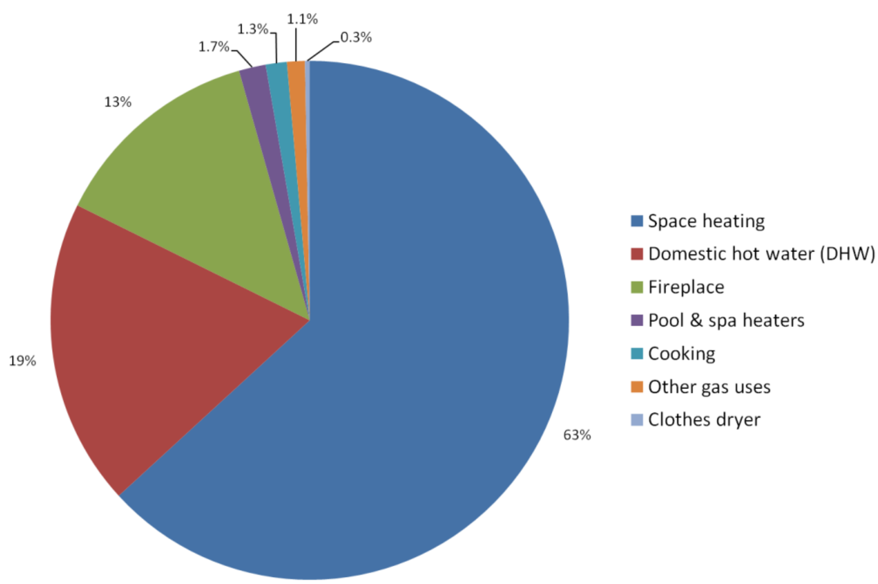


Exhibit 9 Natural Gas Consumption for the Lower Mainland, Modelled by End Use and Dwelling Type, Base Year (1000 GJ/yr.)

Dwelling Types	Space heating	Domestic hot water (DHW)	Fireplace	Cooking	Clothes dryer	Pool & spa heaters	Other gas uses	Grand Total	% of Total
SFD/Duplex, gas heat, pre-1976	14,991	3,800	2,865	402	263	214	47	22,581	43%
SFD/Duplex, gas heat, 1976 or newer	14,914	4,692	3,537	496	324	264	58	24,286	47%
SFD/Duplex, non-gas heat, pre-1976	47	185	186	26	17	14	3	479	1%
SFD/Duplex, non-gas heat, 1976 or newer	47	229	230	32	21	17	4	580	1%
Attached/Row, gas heat, pre-1976	306	122	75	4	6	7	1	521	1%
Attached/Row, gas heat, 1976 or newer	1,480	729	444	25	38	41	6	2,763	5%
Attached/Row, non-gas heat, pre-1976	1	6	5	0	0	0	0	13	0%
Attached/Row, non-gas heat, 1976 or newer	6	36	29	2	2	3	0	78	0%
Mobile/other, gas heat	377	161	76	6	11	9	2	642	1%
Mobile/other, non-gas heat	1	8	5	0	1	1	0	16	0%
Total	32,171	9,969	7,452	994	684	570	120	51,958	100%
% of Total	62%	19%	14%	2%	1%	1%	0%	100%	

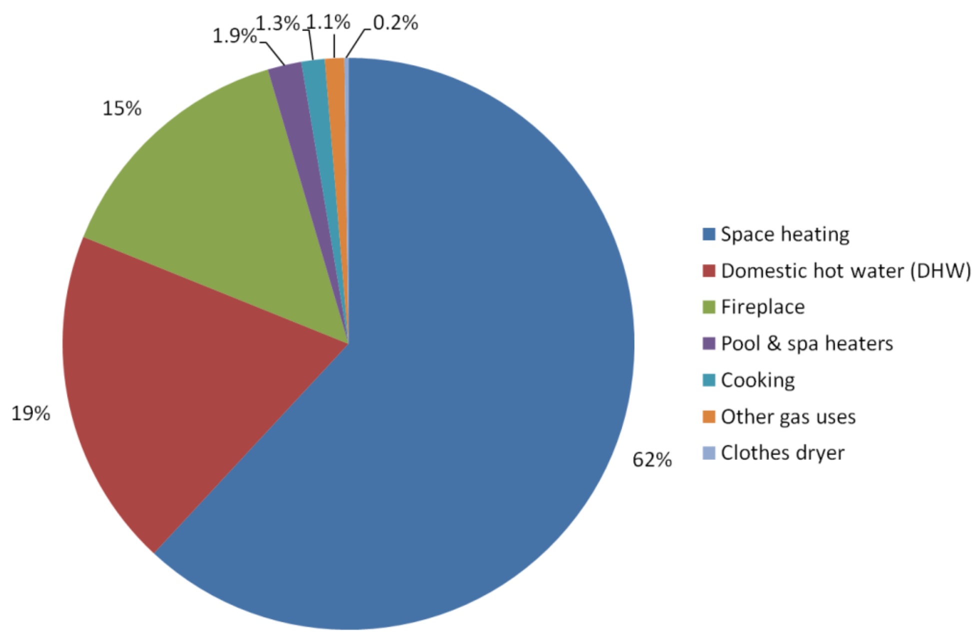
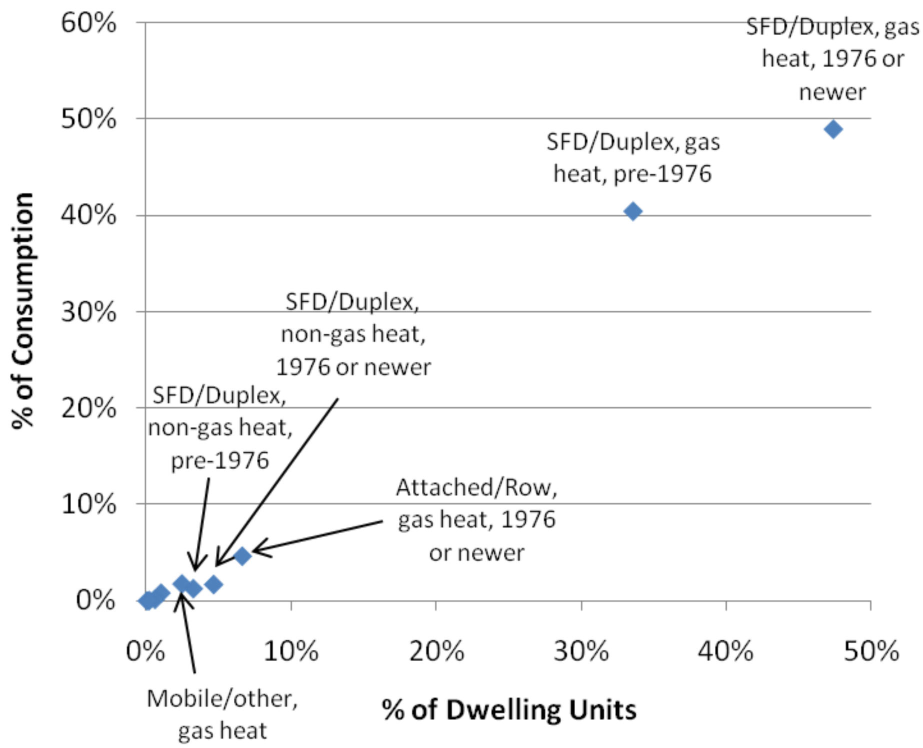
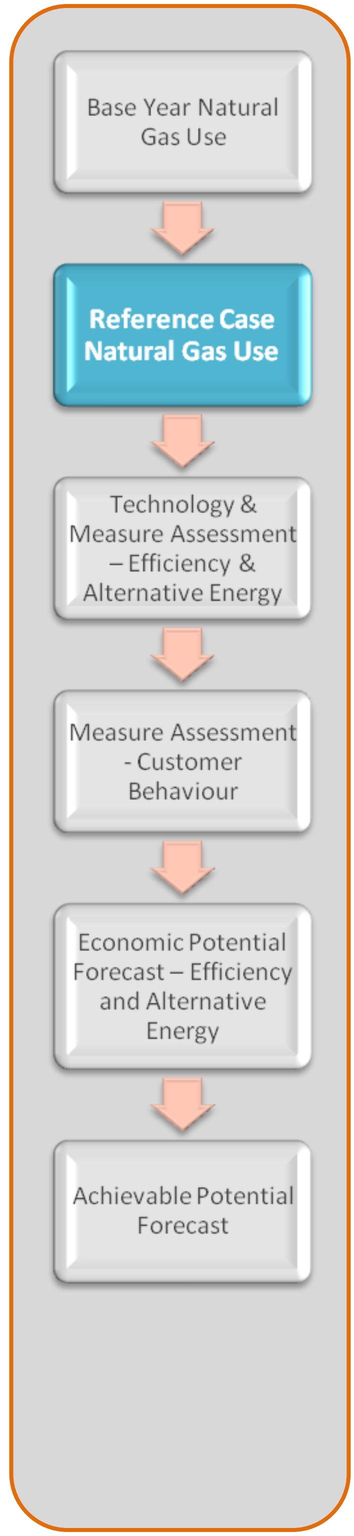


Exhibit 10 Relationship of % of Dwelling Units to % of Consumption



4 Reference Case Natural Gas Forecast

4.1 Introduction



This section presents the Residential sector Reference Case for the study period (2010 to 2030). The Reference Case estimates the expected level of natural gas consumption that would occur over the study period in the absence of new utility-based DSM initiatives conducted by FortisBC.

The Reference Case includes the ongoing effects of DSM activity initiated before the study period, and also includes the effects of DSM activity by other actors in the market, such as BC Hydro. The Reference Case also presents a scenario in which policy, legislation, and regulation continue to exist as they are today. Legislation that is not yet passed or clearly mapped out is subject to influence by FortisBC and is therefore considered within the realm of potential savings.

The Reference Case, therefore, provides the point of comparison for the calculation of energy saving opportunities associated with each of the scenarios that are assessed within this study.

The Reference Case discussion is presented within the following sub sections:

- Methodology
- Summary of model results.

4.2 Methodology

Development of the Reference Case involved the following steps:

- **Step 1**: The growth in the number of residential dwellings was estimated for each dwelling type within each service region, based on FortisBC load forecast data.

- **Step 2:** The net space heating loads for each new dwelling type were estimated within each service region.

- **Step 3:** Naturally-occurring changes in net space heating loads were estimated for existing dwelling types.

- **Step 4**: Naturally-occurring changes in annual natural gas use were estimated for the evolving stock of residential appliances, including the influence of new appliance efficiency standards to be introduced over the study period.

- **Step 5**: Future appliance saturation trends were estimated for each dwelling type and service region.

- **Step 6**: Changes in natural gas share for space heating and each appliance were estimated for each dwelling type and service region.

Further information related to the growth in residential dwellings over the study period and their net space heating loads is provided below.

A detailed discussion of the methodology employed in each of the remaining steps is provided in Appendix B.

4.2.1 *New Residential Dwellings in Study Period*

Exhibit 11 shows the estimated number of residential units in 2010 and 2030, by dwelling type and service region. Tables or charts showing the number of residential units for milestones 2015, 2020, and 2025 can be obtained using Data Manager.

Exhibit 11 shows that attached housing is assumed to grow at a rate 2.95 times as fast as the growth in detached housing. This ratio was derived using the reported ages of dwellings of different types in the FortisBC 2008 REUS. Consequently, by the end of the study period, attached housing is expected to be a larger percentage of the total dwellings, rising from 8% of the total to more than 10% of the total. Total numbers of houses in the exhibit, by the region, are the same as the numbers assumed in the FortisBC load forecast.[10]

[10] The dwelling numbers in this study include only FortisBC customers. Thus, the number of customers who do not heat with natural gas includes only dwellings that have a connection to the FortisBC system and use natural gas for other purposes. The dwelling totals will therefore not match the totals included in conservation potential studies for BC Hydro. The conservation potential study conducted for FortisBC (then Terasen Gas), in 2006 did include the British Columbia dwellings that were not customers of FortisBC, to coordinate with a BC Hydro study at the time. For this study, the decision was made to include only FortisBC customers, because the study could more easily benefit from the data provided in the 2008 Residential End Use Study.

Exhibit 11 Residential Customers, 2010 and 2030, by Region and Dwelling Type, (Number of Units)

Dwelling Types	Number of Dwellings												% of Total
	Lower Mainland		Vancouver Island		Southern Interior		Northern Interior		Whistler		Grand Total		
	2010	2030	2010	2030	2010	2030	2010	2030	2010	2030	2010	2030	
SFD/Duplex, gas heat, pre-1976	195,502	195,502	24,278	24,278	42,485	42,485	24,070	24,070	99	99	286,436	286,436	29%
SFD/Duplex, gas heat, 1976 or newer	241,378	281,002	33,784	57,545	81,743	99,939	46,311	56,621	911	1,011	404,127	496,117	50%
SFD/Duplex, non-gas heat, pre-1976	12,700	12,700	10,159	10,159	3,198	3,198	1,812	1,812	48	48	27,916	27,916	3%
SFD/Duplex, non-gas heat, 1976 or newer	15,681	18,255	14,136	24,079	6,153	7,522	3,486	4,262	437	484	39,892	54,602	5%
Attached/Row, gas heat, pre-1976	7,115	7,115	597	597	760	760	431	431	16	16	8,919	8,919	1%
Attached/Row, gas heat, 1976 or newer	42,401	56,496	4,017	11,111	6,210	9,530	3,518	5,399	503	664	56,649	83,200	8%
Attached/Row, non-gas heat, pre-1976	462	462	250	250	57	57	32	32	8	8	809	809	0%
Attached/Row, non-gas heat, 1976 or newer	2,754	3,670	1,681	4,649	467	717	265	406	241	318	5,409	9,761	1%
Mobile/other, gas heat	9,508	10,558	1,427	2,130	6,574	7,652	3,724	4,335	15	17	21,248	24,692	2%
Mobile/other, non-gas heat	618	686	597	891	495	576	280	326	7	8	1,997	2,488	0%
Grand Total	528,119	586,447	90,926	135,689	148,143	172,437	83,930	97,695	2,285	2,673	853,403	994,941	
% of Total	62%	59%	11%	14%	17%	17%	10%	10%	0.3%	0.3%	100%	100%	

4.2.2 *Net Space Heating Loads in New Dwellings*

Exhibit 12 provides a summary of the net space heating load by dwelling type and service region. A detailed description of the data sources and approach used to estimate the levels shown in Exhibit 12 is provided in Appendix B. The space heating loads shown below are for any dwellings built after the Base Year. The study does not assume significant improvement in space heating loads or significant change in floor area for new homes built during the study period.

Exhibit 12 New Residential Dwellings—Net Space Heating Loads by Building Type and Service Region, (MJ/yr.)

Dwelling Types	Lower Mainland	Vancouver Island	Southern Interior	Northern Interior	Whistler	Weighted Average
SFD/Duplex, gas heat	55,557	37,620	40,602	76,117	74,460	50,290
SFD/Duplex, non-gas heat	52,422	37,031	40,101	75,179	73,543	42,140
Attached/Row, gas heat	31,392	20,488	25,415	47,646	46,608	28,975
Attached/Row, non-gas heat	23,424	15,792	20,803	39,000	38,151	18,836
Mobile/other, gas heat	35,642	24,267	31,784	59,587	58,290	36,376
Mobile/other, non-gas heat	35,645	24,269	31,787	59,592	58,295	30,488

4.2.3 *Naturally-Occurring Changes in Space Heating and Appliance Efficiency Levels*

Exhibit 13 provides the estimated UEC values for the Lower Mainland region in 2030. The values shown in Exhibit 13 apply to the appliances present in new dwellings constructed in the Lower Mainland. UECs vary slightly by service region, in some cases because of differences in occupancy rates.

The UECs in dwellings constructed both at the beginning and the end of the study period are shown in the exhibit, to illustrate the way they are expected to evolve. The UECs for several of the end uses (such as DHW or cooking) are expected to decrease over the study period because of improvements in efficiency. Where these improvements resulted in total consumption for 2030 that was substantially less than the FortisBC forecast, the “other” end use was increased to compensate.

Further discussion of the estimated UECs values is provided in Appendix B, together with the UECs for the other service regions.

Exhibit 13 Annual Appliance Natural Gas Use (UEC) for the Lower Mainland in 2030 (MJ/yr.)

Dwelling Types	Domestic hot		Fireplace		Cooking		Clothes dryer		Pool & spa heaters		Other gas uses	
	2010	2030	2010	2030	2010	2030	2010	2030	2010	2030	2010	2030
SFD/Duplex, gas heat, pre-1976	21,061	14,019	25,833	25,833	5,694	3,874	4,607	4,385	27,693	27,693	1,093	6,340
SFD/Duplex, gas heat, 1976 or newer	21,061	14,019	25,833	25,833	5,694	3,874	4,607	4,385	27,693	27,693	1,093	6,340
SFD/Duplex, non-gas heat, pre-1976	21,061	14,019	25,833	25,833	5,694	3,874	4,607	4,385	27,693	27,693	1,093	6,340
SFD/Duplex, non-gas heat, 1976 or newer	21,061	14,019	25,833	25,833	5,694	3,874	4,607	4,385	27,693	27,693	1,093	6,340
Attached/Row, gas heat, pre-1976	18,750	12,480	15,709	15,709	5,079	3,455	4,102	3,904	27,693	27,693	973	5,644
Attached/Row, gas heat, 1976 or newer	18,750	12,480	15,709	15,709	5,079	3,455	4,102	3,904	27,693	27,693	973	5,644
Attached/Row, non-gas heat, pre-1976	18,750	12,480	15,709	15,709	5,079	3,455	4,102	3,904	27,693	27,693	973	5,644
Attached/Row, non-gas heat, 1976 or newer	18,750	12,480	15,709	15,709	5,079	3,455	4,102	3,904	27,693	27,693	973	5,644
Mobile/other, gas heat	18,369	12,227	15,389	15,389	4,962	3,375	4,007	3,814	27,693	27,693	953	5,529
Mobile/other, non-gas heat	18,369	12,227	15,389	15,389	4,962	3,375	4,007	3,814	27,693	27,693	953	5,529
Weighted Average	20,779	13,807	24,622	24,463	5,619	3,816	4,545	4,319	27,693	27,693	1,078	6,244
Percent Change		-34%		-1%		-32%		-5%		0%		479%

4.2.4 *Appliance Saturation and Fuel Share Trends*

Appliance saturations and fuel shares are currently held constant throughout the study period. There is anecdotal evidence that some saturations and fuel shares are changing, specifically the natural gas fuel share for DHW. For example, as condensing gas furnaces are installed in new houses, natural gas DHW can only be installed if the builder chooses either a power-vented gas water heater or expensive venting dedicated to an atmospheric unit. Consequently, more builders are installing electric water heaters instead. Data on this phenomenon were not available at the time of the study, so no adjustment was made to DHW fuel shares over the study period.

4.3 Summary of Results

This section presents the results of the model runs for the entire study period. The results are presented for the total FortisBC service area and for the Lower Mainland. Results for the remaining service regions are provided in Appendix B.

- Exhibit 14 presents the model results in tabular form, by dwelling type, end use and milestone year
- Exhibit 15 presents the model results for 2030 by region
- Exhibit 16 presents the model results for 2030 by dwelling type
- Exhibit 17 presents the model results for 2030 by end use
- Exhibit 18 shows the evolving relative contribution of different end uses towards the total consumption in different dwelling types.

Selected highlights of are provided below.

By Dwelling Type

- The percentage of natural gas supplied to single detached or duplex dwellings is expected to fall from 92% to 91% by 2030.
- The percentage supplied to attached dwellings is expected to rise from 6% to 7%, while the mobile homes are expected to consume approximately 2% throughout the study period.
- This modest shift towards a greater share of consumption in attached dwellings is driven by higher growth rates for those types of houses.

By End Use

- Approximately 61% of the natural gas FortisBC supplies to residential customers is expected to be used for space heating in 2030.
- Approximately 15% will be used for heating water.
- Approximately 16% will be used in natural gas fireplaces.
- Pools and spas, cooking, and clothes dryers are expected to continue to use less than 4% of residential natural gas consumption, but the other category is projected to increase to 6% of consumption. This reflects the potential emergence of new uses for natural gas in addition to the barbecues, patio heaters, patio lights and other growing uses.

By Service Region

- Customers in the Lower Mainland region will consume approximately 69% of the natural gas FortisBC supplies to residential customers.
- Customers in the Inland Southern and Inland Northern regions each consume 12% of the residential natural gas.
- Customers in the Vancouver Island region consume 7% of the residential natural gas and customers in Whistler consume less than 1%.

By Dwelling Type and End Use

The last exhibit in this chapter shows the trends in consumption by major end-use groupings. The following key observations can be made:

- Heating is expected to decrease moderately as a share of residential natural gas consumption between now and 2030. Although the heating consumption per house is expected to decline, it will fall only slightly faster than other uses.

- DHW is expected to consume a declining share of residential natural gas consumption between now and 2030. This is because a mandated improvement in the equipment efficiency will be combined with reductions in DHW use due to improved clothes washers and dishwashers and increases in low-flow fixtures.

- Fireplaces are expected to consume a rising share of residential natural gas consumption between now and 2030, because their number is expected to increase and improvements in their efficiency are uncertain.

- Most remaining end uses are expected to consume approximately the same share of residential natural gas throughout the study period, but the other category is projected to increase.

- The increase in the “other gas uses” is, in part, used to ensure that the total Reference Case consumption in this study matches the FortisBC forecast. It is also consistent with past experience, which suggests that consumers find new uses for energy that largely offset conservation in the existing end uses.

Exhibit 14 Reference Case Forecast, Total FortisBC Service area (1000 GJ/yr.)

Dwelling Types	Milestone Years	Space heating	Domestic hot water (DHW)	Fireplace	Pool & spa heaters	Cooking	Clothes dryer	Other gas uses	TOTAL	% of Total
Single Family Dwelling	2010	43,878	12,807	9,088	1,202	899	208	743	68,825	92%
	2015	41,554	11,930	9,465	1,242	855	216	1,404	66,666	92%
	2020	41,441	11,380	9,782	1,276	835	223	2,089	67,027	92%
	2025	41,144	10,292	10,042	1,305	746	227	2,791	66,546	92%
	2030	40,727	9,549	10,280	1,331	696	231	3,512	66,326	91%
Attached Dwelling	2010	2,297	1,103	667	36	59	11	66	4,240	6%
	2015	2,297	1,083	740	39	60	12	141	4,373	6%
	2020	2,413	1,080	809	42	62	13	225	4,644	6%
	2025	2,508	1,020	869	45	59	14	315	4,830	7%
	2030	2,590	981	929	48	57	16	413	5,032	7%
Mobile/Other Dwelling	2010	861	324	135	9	21	6	18	1,375	2%
	2015	828	304	142	10	21	6	31	1,342	2%
	2020	835	292	148	10	20	6	45	1,357	2%
	2025	837	266	153	10	18	6	59	1,349	2%
	2030	836	248	157	11	17	6	73	1,348	2%
TOTAL	2010	47,036	14,234	9,890	1,247	980	224	828	74,440	
	2015	44,679	13,317	10,348	1,291	936	234	1,577	72,382	
	2020	44,689	12,752	10,739	1,329	917	243	2,359	73,027	
	2025	44,489	11,577	11,064	1,360	823	247	3,165	72,726	
	2030	44,153	10,778	11,366	1,389	770	253	3,998	72,707	
% of Total		61%	15%	16%	2%	1%	0%	5%	100%	

Exhibit 15 Reference Case Forecast, 2030, by Region, (%)

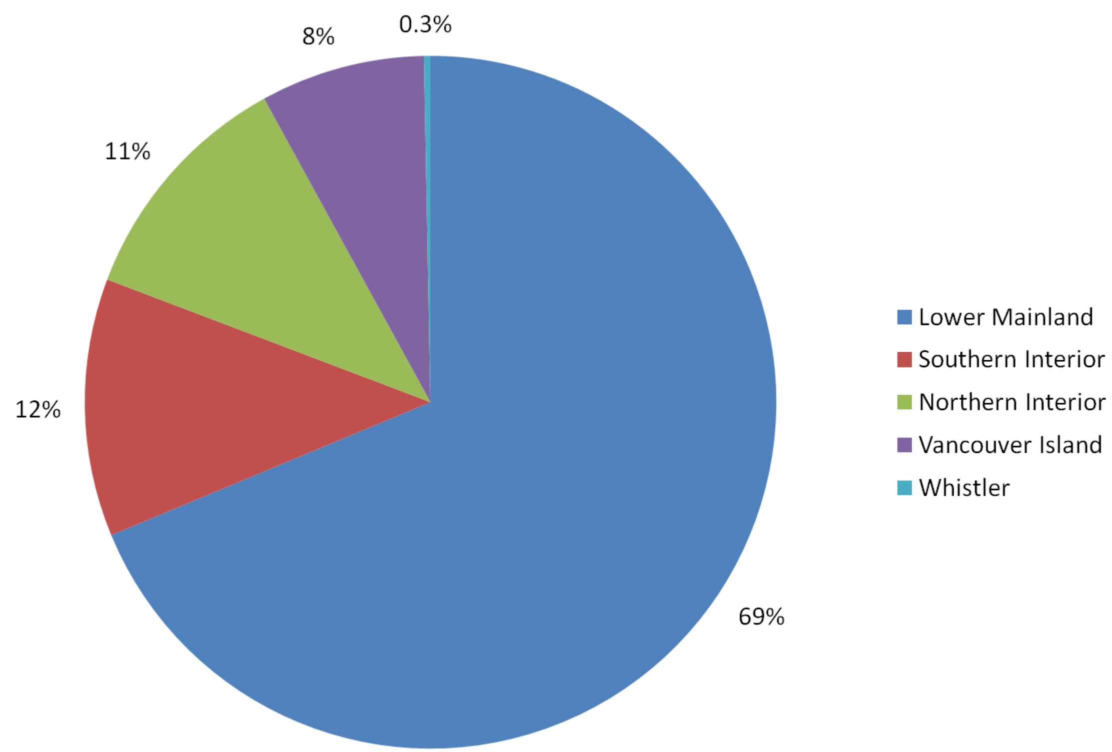


Exhibit 16 Reference Case Forecast, 2030, by Dwelling Type, (%)

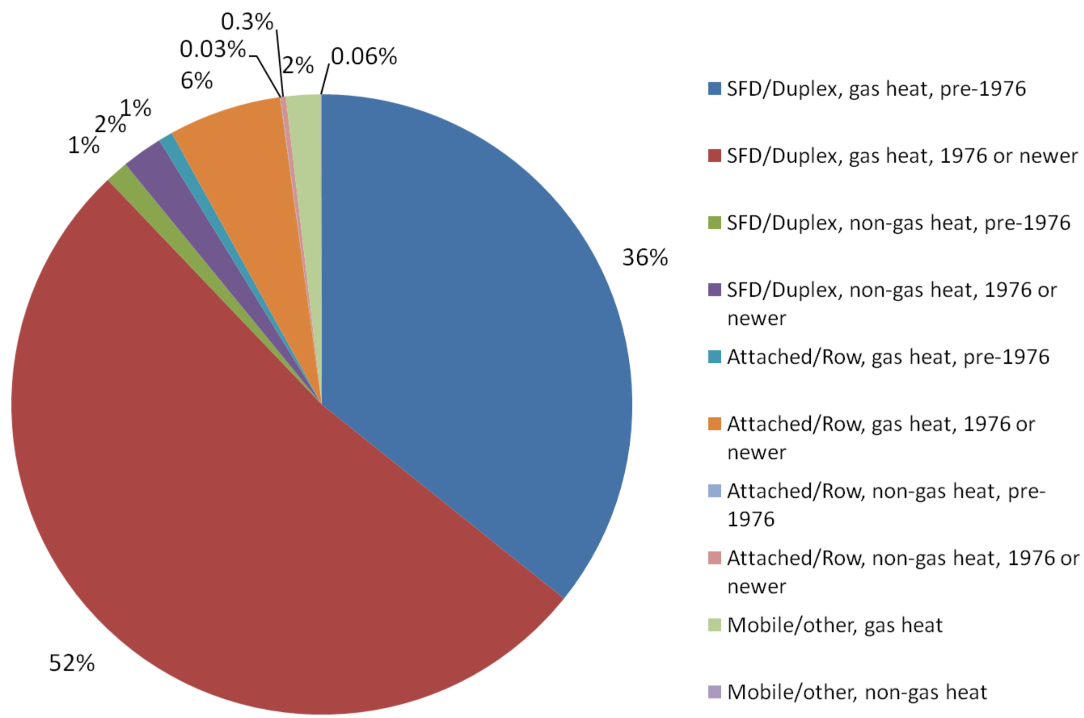


Exhibit 17 Distribution of Natural Gas Consumption by End Use, in 2010 and 2030, (1000 GJ/yr.)

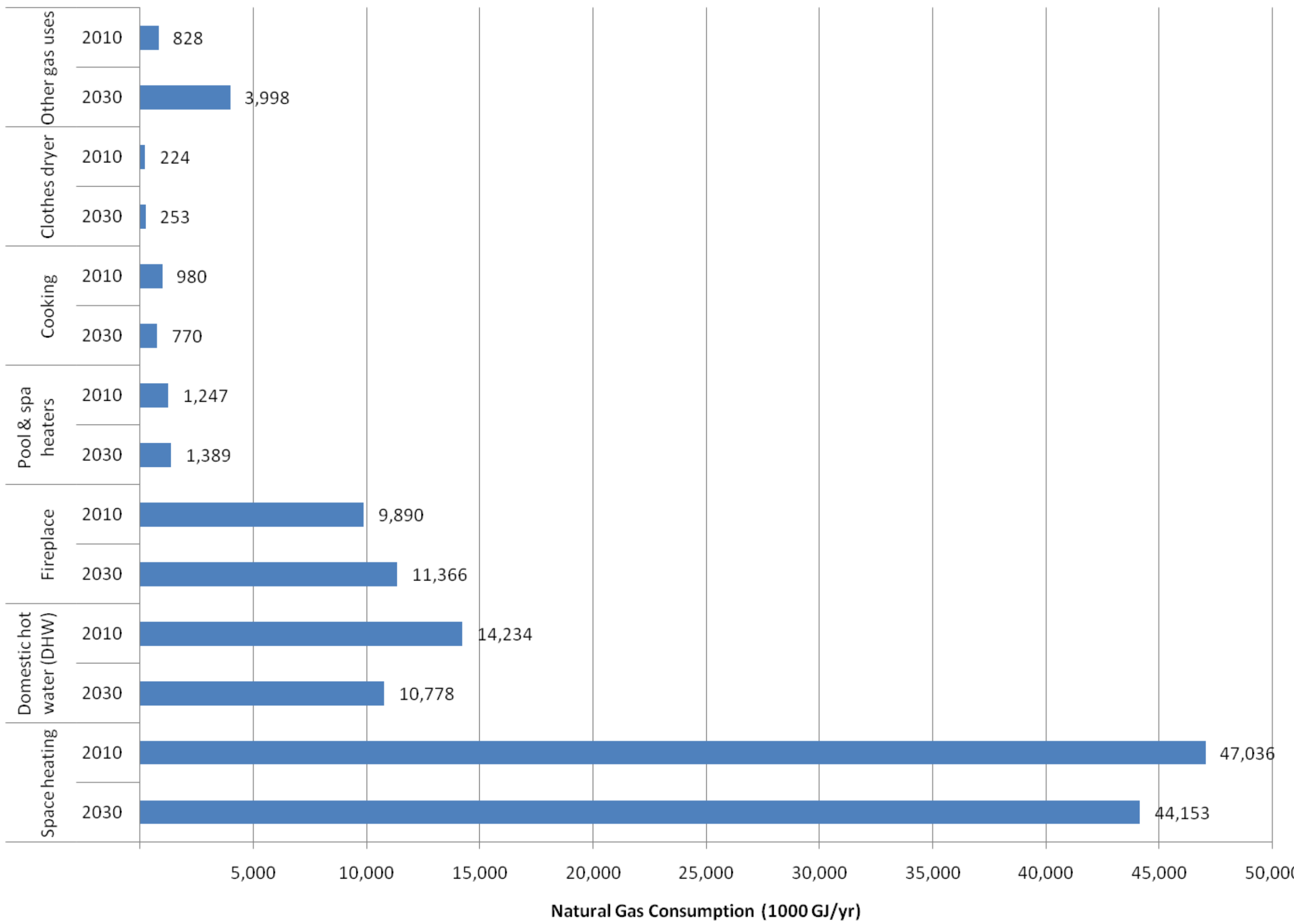
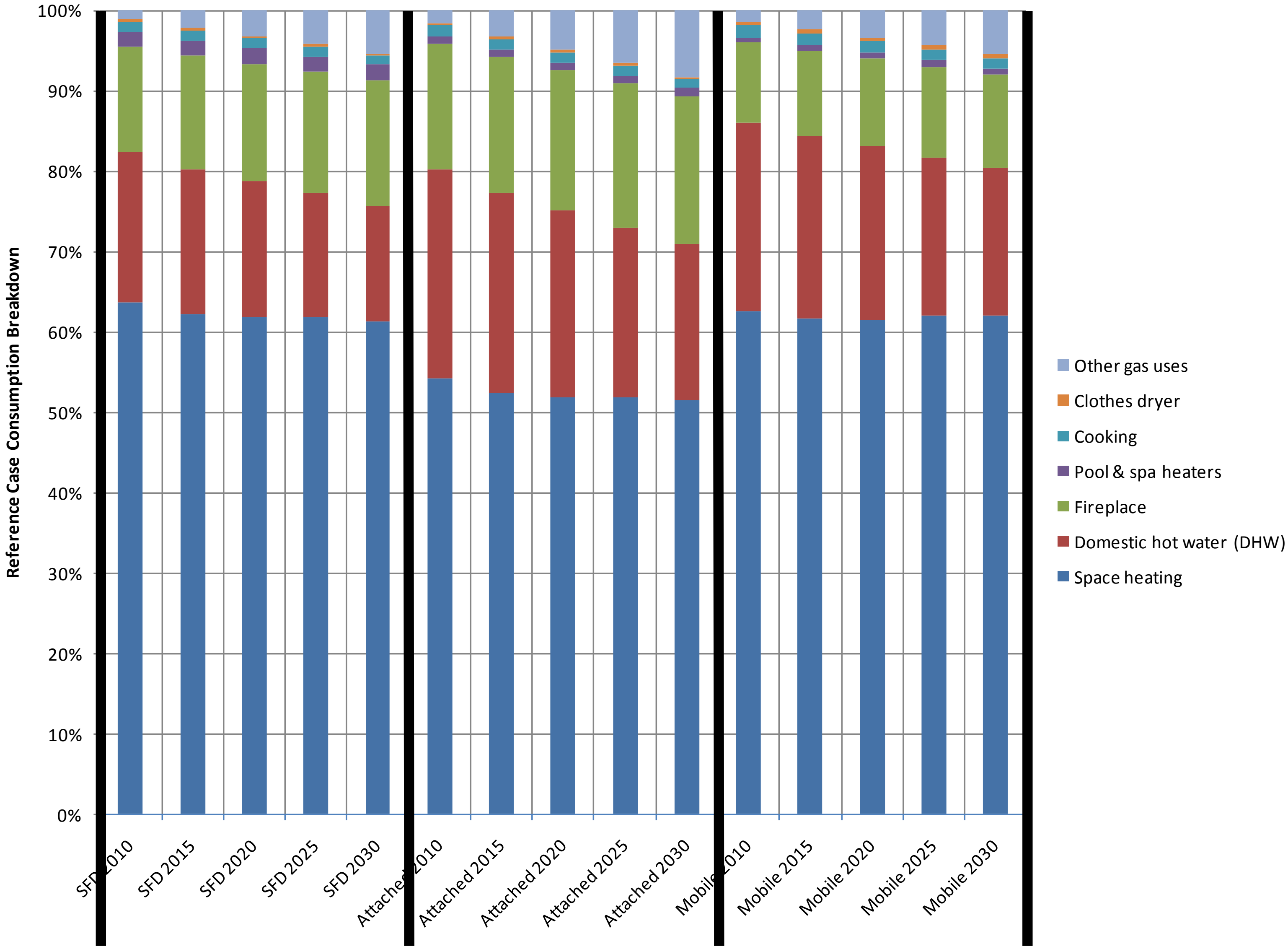


Exhibit 18 Distribution of Natural Gas Consumption, by Dwelling Type and End Use, Trends to 2030



5 Technology & Measure Assessment

5.1 Introduction

This section identifies and assesses the financial and economic attractiveness of the selected energy-efficiency and alternative energy measures for the Residential sector. The discussion is organized and presented as follows:

- Methodology
- Energy-efficiency and alternative energy technologies
- Summary of results.

5.2 Methodology

The following steps were employed to assess the energy-efficiency and alternative energy measures:

- Select candidate energy-efficiency measures
- Establish technical performance for each option within a range of applicable load sizes and/or service region conditions (e.g., degree days)
- Establish the capital, installation and operating costs for each option
- Calculate the simple payback from the customer's perspective
- Calculate the measure TRC
- Calculate the benefit-cost ratio.

A brief discussion of each step is outlined below.

Step 1 Select Candidate Measures

The candidate measures were selected in close collaboration with FortisBC personnel based on a combination of a literature review and the previous experience of both the consultants and FortisBC personnel. The selected measures are all considered to be technically proven and commercially available, even if only at an early stage of market entry. Technology costs, which will be addressed in this section, were not a factor in this initial selection of candidate technologies.

Step 2 Establish Technical Performance

Information on the performance improvements provided by each measure was compiled from available secondary sources, including the experience and on-going research work of study team members. As applicable, the energy impacts of the measures are reported for both natural gas and electricity.

Step 3 Establish Capital, Installation and Operating Costs for Each Measure

Information on the cost of implementing each measure was also compiled from secondary sources, including the experience and on-going research work of study team members. As applicable, both the incremental and full cost of each measure were estimated.

The incremental cost is applicable when a measure is installed in a new facility, or at the end of its useful life in an existing facility; in this case, incremental cost is defined as the difference between the energy-efficiency or alternative energy option relative to the baseline technology. The full cost is applicable when an operating piece of equipment is replaced with a more efficient model or an alternative energy option prior to the end of its useful life.

In both cases, the costs and savings are annualized, based on the number of years of equipment life and the discount rate, and the costs incorporate applicable changes in annual O&M costs. All costs are expressed in constant (2010) dollars.

Step 4 Calculate Simple Payback

The simple payback is generated to show the customer's financial perspective. Simple payback is "*a measure of the length of time required for the cumulative savings from a project to recover its initial investment cost and other accrued costs, without taking into account the time value of money. The simple payback period is usually measured from the service date of the project*."[11] The cost of the measure (incremental or full, as appropriate) is divided by the expected annual savings. The answer is given in years.

The following equation illustrates how this calculation is applied to a situation where an upgrade has a higher upfront cost than the baseline technology, but lower ongoing operating costs:

$$\text{Payback}_{(\text{years})} = (\text{CostUpgr} - \text{CostBase})/(\text{AnnBase} - \text{AnnUpgr})$$

where:

CostUpgr	= initial capital cost of the upgrade measure ($)
CostBase	= initial capital cost of the baseline measure ($)
AnnUpgr	= ongoing operating cost of the upgrade ($/year)
AnnBase	= ongoing operating costs of the baseline technology ($/year)

Step 5 Calculate the Measure Total Resource Cost (TRC)

The measure TRC calculates the net present value of energy savings that result from an investment in an efficiency or alternative energy technology or measure. The measure TRC is equal to its full or incremental capital cost (depending on application) plus any change (positive or negative) in the combined annual energy and O&M costs. This calculation includes, among others, the following inputs: the avoided natural gas and electricity supply costs, the life of the technology, and the selected discount rate, which in this analysis has been set at 7.38% for most of the regions and 6.87% for Vancouver Island.

A technology or measure with a positive TRC value is included in subsequent phases of the analysis, which consists of the Economic and Achievable Potential scenarios. A measure with a

[11] Sieglinde K. Fuller and Stephen R. Petersen. (1996). "*Life Cycle Costing Manual for the Federal Energy Management Program".* National Institute of Standards and Technology Handbook 135, 1995 Edition, Washington, DC.

negative TRC value is not economically attractive and is therefore not included in subsequent stages of the analysis.

It should be noted that the measure TRC provides an initial screen of the technical options. Considerations such as program delivery costs, incentives, etc., are incorporated in later detailed program design stages, which are beyond the scope of this study.

Step 6 Calculate Benefit-Cost Ratio

The measure benefit-cost ratio indicates the relative attractiveness of the measures. A measure that has a benefit-cost ratio in excess of "1" means that the measure's benefits outweigh its costs; it is, therefore, included in subsequent stages of the analysis. Similarly, a measure with a benefit-cost ratio that is well in excess of one (e.g., 3) means that it is very attractive. A measure with a benefit-cost ratio of less than one means that its costs outweigh its benefits and, hence, is not included in subsequent stages of the analysis.

5.2.1 *Energy Costs*

The financial and economic results presented in this section are based on the following:

- Avoided supply cost of natural gas
- Avoided supply cost of electricity
- Customer energy prices.

A brief discussion of each is provided below.

Avoided Supply Cost of Natural Gas

Natural gas avoided supply costs were provided by FortisBC[12] and are summarized in Exhibit 19. As illustrated, the avoided cost of gas on a per unit basis includes three components: an estimate of the commodity cost, an estimate of the distribution cost and the carbon tax.

- The commodity cost is based on the 10-year AECO price forecast according to GLJ Petroleum Consultants (an independent energy consultant) based on their latest available forecast (updated by GLJ each quarter).

- The distribution costs are estimated by calculating an approximation of the pipeline transportation charges required by FortisBC to move the commodity supply to core markets as well as the storage costs associated with meeting winter load requirements.

- The carbon tax values shown are based on current estimates of $20/ton, $25/ton for 2011 and then remaining constant at $30/ton from 2011 and beyond.

The resulting avoided costs represent the expected marginal cost of to serve FortisBC's customers on a per unit basis. In this study, no distinction has been made between high load factor (flat) and low load factor (peaky) load shapes, or between different service areas within the province.

[12] FortisBC, Supply Group. Values are updated quarterly.

Exhibit 19 Natural Gas – Avoided Supply Costs ($/GJ)

Year	Commodity Cost	Distribution	Carbon Tax	Total
2010	$ 5.59	0.15	0.75	$ 6.49
2011	$ 5.88	0.15	1.00	$ 7.03
2012	$ 6.61	0.15	1.25	$ 8.01
2013	$ 7.32	0.15	1.50	$ 8.97
2014	$ 7.92	0.15	1.50	$ 9.57
2015	$ 8.41	0.15	1.50	$ 10.06
2016	$ 8.82	0.15	1.50	$ 10.46
2017	$ 9.14	0.15	1.50	$ 10.78
2018	$ 9.35	0.15	1.50	$ 11.00
2019	$ 9.57	0.15	1.50	$ 11.22
2020	$ 9.78	0.15	1.50	$ 11.43
2021	$ 9.99	0.15	1.50	$ 11.64
2022	$ 10.21	0.15	1.50	$ 11.86
2023	$ 10.43	0.15	1.50	$ 12.08
2024	$ 10.66	0.15	1.50	$ 12.31
2025	$ 10.89	0.15	1.50	$ 12.54
2026	$ 11.13	0.15	1.50	$ 12.78
2027	$ 11.37	0.15	1.50	$ 13.02
2028	$ 11.62	0.15	1.50	$ 13.27
2029	$ 11.87	0.15	1.50	$ 13.52
2030	$ 11.87	0.15	1.50	$ 13.52

Avoided Supply Cost of Electricity

The avoided supply cost of electricity used in this analysis is $0.12/kWh.[13] This value is higher than the current average cost for BC Hydro to deliver electricity to a Lower Mainland busbar. The added cost reflects a number of recent bids for new electricity supply options. The value was adjusted to add 7% for area transmission and distribution losses between the busbar and the customer.

BC Hydro is confronted with higher supply costs for end uses such as space heating that have peaky requirements. However, detailed electricity supply costs were not available for this study for each of the defined load types. BC Hydro also did not generate distinct avoided cost values to be used for different regions in the last BC Hydro CPR. Furthermore, the current study uses the same natural gas avoided costs for all load types and regions. Consequently, it was decided to use the same avoided cost for electricity throughout the study.

Customer Energy Prices

The Residential sector customer energy prices used in this analysis are $0.083/kWh[14] for electricity and $0.01/MJ for natural gas. Both prices are from a proprietary FortisBC Energy Inc. (FEI) planning tool provided to the consultant team by FortisBC.

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[13] $33.33/GJe.
[14] $23.06/GJe. Value provided by FortisBC, November 2010.

5.3 Technology and Measure Assessment

Exhibit 20 lists the energy-efficiency technologies and measures that are included in this study. A description and detailed financial and economic assessment of each measure is provided in the measure TRC model that accompanies this report. An example of the TRC model worksheet for one measure is provided in Appendix C.

Exhibit 20 Efficiency and Alternative Energy Technologies Included in this Study

- **Heating: Shell Measures**
  - Insulation – attic, wall, slab, basement, crawlspace
  - Air sealing/weather stripping/caulking – average and old homes
  - High-performance (ENERGY STAR™) windows
  - Super high-performance windows
- **Heating: Shell (New Homes)**
  - High-performance new homes (EGH 80 /R2000/ENERGY STAR™)
  - Near-zero/Net-zero energy homes
- **Heating: Equipment**
  - Furnaces above standard efficiency (>90%)
  - Condensing boilers
  - Programmable thermostats
  - Solar pre-heated make-up air systems (e.g., SolarWall™)
  - High-efficiency heat recovery ventilators (HRVs)
  - Integrated heating and DHW/hydronic combination systems
  - Gas-fired air heat pumps
  - Gas-fired GS heat pumps
- **Water Heating**
  - Condensing water heaters
  - Tankless water heaters
  - Solar water heating
  - DHW tank insulation
  - DHW pipe insulation
  - DHW heat trap
  - Ultra low-flow showerheads
  - Low-flow aerators
  - Wastewater heat recovery
  - DHW recirculation (e.g. Metlund D'MAND™)
- **Appliances**
  - DHW savings from efficient dishwashers
  - DHW and dryer savings from efficiency clothes washers
  - Moisture sensors in dryers
- **Other**
  - High-efficiency/EnerChoice gas fireplaces
  - Insulating pool covers
  - Heat pump pool heaters
  - High-efficiency pool heaters
  - Solar pool heaters
  - Micro-CHP

Descriptions of each of these measures are provided in Appendix C.

5.3.1 *Technology Screening Results*

A summary of the results is provided in Exhibit 21. For each of the measures reviewed, the Exhibit shows:

- The name of the measure
- The cost basis[15] for the cost of conserved energy (CCE) that is shown, e.g., "full" versus "incremental"
- The measure's average CCE when applied to existing dwellings and to new dwellings.

Measures that pass on the basis of full cost are qualitatively different from the measures that pass only on an incremental basis. A measure that passes on a full-cost basis can be applied immediately, even if the piece of equipment that it replaces or improves is currently working properly. That means the rate at which the measure can be implemented as a utility DSM measure is limited by market and program constraints. A measure that passes only on an

[15] See Step 3 in Section 5.2 for a fuller description.

incremental basis, on the other hand, is limited by the rate of natural replacement (due to failure or obsolescence) or purchase of the piece of equipment it replaces.

In Exhibit 21 the TRC $ column is the total present value of all the benefits included in the TRC test minus the total present value of all the costs included in the TRC test, for the life of the measure. These benefits and costs are calculated per measure implemented, and do not include program costs. The benefit-cost ratio is the present value of the benefits in the TRC test divided by the present value of the costs in the TRC test. A measure whose TRC $ value is slightly more than $0 will have a benefit-cost ratio slightly over 1, and will pass the TRC test.

Exhibit 21 Residential Sector Energy-efficiency Technology Measures, Screening Results, Lower Mainland

Measure Name	Basis (Full/ Incremental)	Weighted Average	
		B/C Ratio	Measure TRC ($)
DHW Pipe Insulation	Full	18.33	$12
Ultra Low-Flow Showerheads	Full	10.35	$122
Programmable Thermostats (Central Heating and Cooling)	Full	6.35	$267
Faucet Aerators	Full	5.42	$66
Solar Pool Heaters	Full	1.25	$851
DHW Tank Insulation	Full	0.98	-$1
Attic Insulation	Full	0.88	-$78
Insulating Pool Covers	Full	0.86	-$169
Homeowner Air Sealing/Weather Stripping/Caulking	Full	0.85	-$51
DHW Recirculation Systems (e.g. Metlund D'MAND®)	Full	0.63	-$206
Air Leakage Sealing and Insulation (Old Homes)	Full	0.57	-$1,375
Wastewater Heat Recovery Systems	Full	0.49	-$399
Professional Air Sealing/Weather Stripping/Caulking	Full	0.46	-$1,086
Crawlspace Insulation	Full	0.33	-$538
Net-Zero Ready Energy Homes	Full	0.28	-$9,260
Active Solar Water Heating Systems	Full	0.24	-$5,326
Solar Pre-Heated Make-Up Air Systems (e.g., SolarWall®)	Full	0.17	-$1,073
High-Efficiency Gas Fireplaces	Incr.	3.67	$400
High-Efficiency (ENERGY STAR®) Clothes Washers	Incr.	1.00	-$1
Basement (Foundation) Insulation	Incr.	0.92	-$95
Wall Insulation	Incr.	0.88	-$228
Super High-Performance Windows	Incr.	0.56	-$1,266
Point-of-Use (Tankless) Water Heaters (Gas)	Incr.	0.42	-$1,154
Micro-Combined Heat and Power (CHP)	Incr.	0.35	-$5,163
High-Efficiency (ENERGY STAR®) Dishwashers	Incr.	0.34	-$69
Integrated Heating and DHW (Hydronic Heating)	Incr.	0.33	-$4,034
Early Retirement of Existing Gas Furnaces	Incr.	0.32	-$1,260
High-Efficiency Heat Recovery Ventilators (HRVs)	Incr.	0.31	-$412
Condensing Gas Water Heaters	Incr.	0.30	-$936
High-Efficiency Condensing Gas Furnaces	Incr.	0.28	-$1,062
Condensing Gas Boilers	Incr.	0.24	-$2,432
Zoned-Up Windows: (ENERGY STAR®) Rating for a Colder Zone	Incr.	0.23	-$1,377
Integrated Heating and DHW (Forced Air Heating)	Incr.	0.17	-$5,142
Slab Insulation (Unfinished Basements)	Incr.	0.10	-$1,069
High-Efficiency Gas-Fired Pool Heaters	Incr.	0.07	-$2,696

Highlights are summarized below:

- The most attractive measures pass the economic screen on a full-cost basis. This implies that they can be implemented immediately. In contrast, measures that pass the economic screen on an incremental cost basis are assumed to be implemented when equipment or material is being replaced.

- When the weighted average results are considered, only six of the 35 measures analyzed currently pass the economic screen. However, there are several other measures that only marginally fail the economic screen.

  - The most attractive measures include DHW pipe insulation, ultra low-flow showerheads, programmable thermostats, faucet aerators, solar pool heaters, and high-efficiency gas fireplaces.
  - Measures that marginally fail the economic screen include DHW tank insulation, basement (foundation insulation), and high-efficiency (ENERGY STAR®) clothes washers. Although these measures fail the economic screen on average, a more detailed analysis of the results shows that, in some cases, they pass the economic screen in certain housing types. This is due to the varying consumption levels in the different types of homes.

- DHW measures that fail the economic screen include the condensing water heater, the instantaneous water heater, wastewater heat recovery, and solar water heating. All these measures have upfront costs that are too high relative to the value of their energy savings.

- Innovative new technologies, such as the micro-combined heat and power (CHP) units do not currently pass the economic screen.

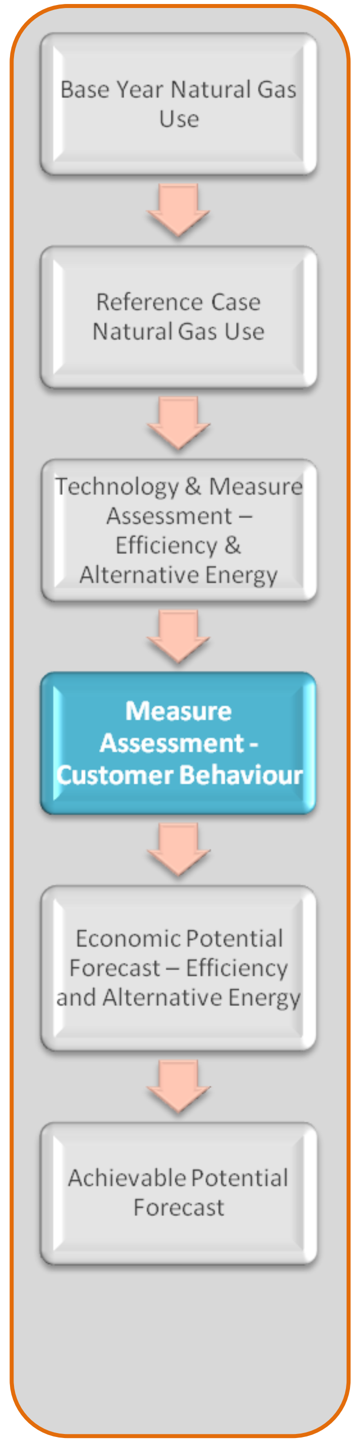
- Several measures that were included in the original list of measures were excluded from the final analysis or modified:

  - **Gas-fired heat pumps -** Research indicated that residential-sized units are not yet available.
  - **DHW heat traps -** This option no longer applies because most new hot water heaters include an integrated heat trap.
  - **High-efficiency gas clothes dryers -** This option is no longer valid because almost all new gas dryers have moisture sensors. Cutting-edge technologies, such as microwave clothes dryers, heat pump clothes dryers, and clothes dryers with heat recovery, are currently under development and they should be monitored for inclusion in future studies.
  - **Heat pump pool heaters -** This represents a fuel switching measure (i.e., from gas to electricity). Thus, it has been removed from the list of measures analyzed.
  - **High-performance (EGH 80/R2000/ENERGY STAR®) homes -** This measure has been superseded by changes to the building code, the ENERGY STAR® standard, and standard building practice that will soon require all new homes meet an energy rating of EGH 80.
  - **Net-zero homes -** Since this measure would displace a large amount of electricity rather than natural gas, it was modified to reflect the building of a net-zero ready home. This implies a home with extremely low space heating loads (~EGH 86), where the remaining electrical load could be displaced by the addition of renewable energy generation.

The benefit-cost ratio presented in Exhibit 21 for each measure is an average for all the housing types in the Lower Mainland region. Measures pass or fail for each housing type and region based on the benefit-cost ratio for that housing type, in that region. Therefore, a number of measures whose benefit-cost ratio in the exhibit is marginally below 1 will pass in certain niches. Other measures whose benefit-cost ratios are slightly over 1 may fail in some regions or housing types. This pattern is shown more clearly in Section 7.

6 Measure Assessment – Customer Behaviour

6.1 Introduction



This section identifies and assesses the potential natural gas savings that could be provided by the actions of customers who habitually save energy within their daily routines. The discussion is organized and presented as follows:

- Methodology
- Description of Residential sector behaviour measures
- Summary of "unbundled" results.

6.1.1 *Methodology*

The following steps were employed to assess the behaviour measures:

- Step 1: Select candidate behaviour measures
- Step 2: Develop baseline of participants for selected behaviours
- Step 3: Develop estimates for unused energy services
- Step 4: Develop unbundled/Economic Potential for energy.

A brief discussion of each step is outlined below.

Step 1 Select Candidate Behaviour Measures

There are a wide number of behaviours that homeowners and building occupants can undertake that affect natural gas consumption.

For this study, the number of behaviours was narrowed by looking at the potential size of the impact, the availability of information, and by consulting with FortisBC personnel.

Step 2 Develop Baseline for Selected Behaviours

Once the behaviours of interest were defined, it was then necessary to determine what share of the customer base already performed those behaviours on a routine basis.

The FortisBC 2008 REUS included a series of questions regarding current behaviour practices. These were developed in anticipation of the CPR and provide a good overlap with the selected behaviours.

Data from the survey were analyzed to determine the share of the current population that states that they are currently undertaking the specified behaviours and how frequently. These data were collected on a four-point scale (always, usually, occasionally, never).

Step 3 Develop Estimates of Potential for Unused Energy Services

The next step was to determine the share of the Base Year consumption that goes to the production of unused energy services. These are the energy services that are produced unnecessarily and therefore provide the potential to reduce the energy requirement. Unused energy services may also be thought of as waste.

The approach was to develop simple engineering estimates to approximate the amount of unused energy services that are embedded in each end use from the Base Year consumption estimates. For example, if 30% of the households are not setting back the temperature at night, and that temperature setback would reduce heating consumption by 5%, then the share of the space heating consumption that is available by increasing this behaviour can be estimated by combining the two values. These are referred to as unused energy services.

Step 4 Develop Unbundled Economic Potential for Energy

The next step in the assessment was to prepare an approximate estimate of the potential unbundled energy savings that could theoretically be provided by each measure. The term "unbundled" means that the savings for each measure are calculated in isolation of each other as well as other factors that ultimately determine the potential for real life savings.

The strength of this approach is that it provides insight into the relative size of the potential energy savings associated with individual measures; this perspective is often of particular value to program design personnel who may need to consider combinations of measures that differ from those selected for the CPR analysis.

The unbundled potential is calculated as the difference between the baseline level of activity for each behaviour and 100% of the people undertaking that behaviour. For example, if 10% of the population does the behaviour 25% of the time, inducing these 10% to do the behaviour 100% of the time is part of the unbundled potential, as well as inducing the remaining 90% of the population to do the behaviour 100% of the time.

As there is no cost for individuals to undertake a specific behaviour, all of the behaviour measures pass the economic screen.

6.2 Residential Sector Behaviour Measures

The residential behaviours included in this CPR are summarized in Exhibit 22 and are briefly described in the following text.

Exhibit 22 Residential Behaviours

Space Heating *(incl. temp)*

- Temperature setback - night
- Temperature setback - day
- Heat only occupied parts of house
- Maintain draft proofing
- Install storm windows
- Use window coverings to reduce space heat loss
- Reduce opening windows in winter
- Turn off fireplace pilot lights in summer[16]

Domestic Hot Water

- Turn off water heater when on vacation
- Reduce water heater temperature
- Share cold water wash
- Potential for cold water wash
- 5-minute showers

6.2.1 *Space Heating*

Space heating is the major residential end use, accounting for about 63% of the residential natural gas consumption in the Base Year. This section includes data only for houses with natural gas space heating. A number of behaviours were identified where the waste of space heat could be reduced through behaviour change. They are:

- Setting back temperature overnight
- Setting back temperature during the day when no one is at home
- Heating only occupied parts of the home
- Maintaining weather stripping and draft proofing
- Installing storm windows if the dwelling has single-glazed windows
- Using window coverings to reduce heat loss in the winter

Temperature Setback - Night

This behaviour consists of turning down the heat at night and then turning it up again in the morning. The practice can be accomplished either by turning down the heat manually, or by the correct use of a programmable thermostat. The 2008 REUS results show that 83% of FortisBC customers "always" or "usually" currently practice this behaviour.

Based on the REUS results, the average temperature setback was estimated to be 3^{o}C and the typical setback period was from 11 pm to 7 am (eight hours). The associated energy reduction from this behaviour was based on measurements from the Canadian Center for Housing Technology (CCHT).[17]

[16] This behavior was identified during the initial workshop but upon further research it was found that this behavior had not addressed by the REUS. Consequently, it was not included in the analysis due to the absence of base line data.

[17] Manning et al., *The Effects of Thermostat Setback and Setup on Seasonal Energy Consumption: Surface Temperatures and Recovery Time at the CCHT Twin House Research Facility* (Ottawa, 2007).

A summary of the applicable data assumptions for this behaviour is provided below.

Assumptions Used for Analysis	
Applicable dwelling type	All detachments – natural space heat
Applicable end use	Space heating
Estimated unused energy services	0.8%
Eligible population	17%

Temperature Setback - Day

This behaviour consists of turning down the heat when leaving the house and then turning it up again when returning. The practice can be accomplished either by turning down the heat manually, or by the correct use of a programmable thermostat. The 2008 REUS results show that 70% of FortisBC customers “always” or “usually” currently practice this behaviour

For the analysis, an average setback of 3^{o}C was used, based on the REUS 2008 results. It is recognized that there will be a mix of circumstances for people who undertake this practice. In a number of cases where both adults work, the setback will be approximately eight hours per day. However, some of these families have children who return from school in the afternoon, and will, therefore, have a shorter turndown period (perhaps five hours); another group will have only one working adult with the other likely leaving the house for a shorter period of time. An average daytime setback of five hours was assumed.

A summary of the applicable data assumptions for this behaviour is provided below.

Assumptions Used for Analysis	
Applicable dwelling type	All detachments – natural gas space heat
Applicable end use	Space heating
Estimated unused energy services	0.9%
Eligible population	30%

Heat Only Occupied Parts of the House

This behaviour consists of keeping unoccupied parts of the house cooler than the remainder of the house. The REUS 2008 determined that 80% of FortisBC customers have the ability to heat only a part of their dwelling and that 65% of those customers “always” or "usually” keep those unoccupied areas of their house cooler than the occupied areas. Consequently, the REUS 2008 estimated that the eligible population for this behaviour is about 15% of FortisBC customers. A 3^{o}C temperature difference was assumed between the heated and cooler areas of the dwelling.

A summary of the applicable data assumptions for this behaviour is provided below.

Assumptions Used for Analysis	
Applicable dwelling type	All detachments – natural gas space heat
Applicable end use	Space heating
Estimated unused energy services	0.6%
Eligible population	15%

Maintain Draft Proofing

This behaviour consists of routinely checking and repairing the draft proofing in the house, where draft proofing was considered to include weather stripping and sill plates around the doors and caulking around the windows.

The REUS 2008 reported that 28% of FortisBC customers check and maintain weather stripping once a year, or more, 36% reported it on an "as needed" basis, and 16% said they never undertake draft proofing. Note: the eligible population shown below is based on 50% of the "as needed" respondents and 100% of the "never" respondents.

A summary of the applicable data assumptions for this behaviour is provided below.

Assumptions Used for Analysis	
Applicable dwelling type	All detachments – natural gas space heat
Applicable end use	Space heating
Estimated unused energy services	1.7%
Eligible population	34%

Install Storm Windows

This behaviour applies only to those in the 28% of homes with one, or more, single-glazed windows. The REUS 2008 reports that 10% of dwellings with single-glazed windows install storm windows or plastic film. Adjusting for the 90% of people who do not install storm windows to the base of natural gas-heated dwellings gives an eligible population of 25%.

The energy savings is based on modeling the impact of replacing single-glazed windows with double-glazing for those natural gas-heated houses that have at least 10% single-glazed windows.

A summary of the applicable data assumptions for this behaviour is provided below.

Assumptions Used for Analysis	
Applicable dwelling type	All detachments – natural gas space heat, single-glazed windows
Applicable end use	Space heating
Estimated unused energy services	1.2%
Eligible population	25%

Use Window Coverings to Reduce Space Heat Losses

This behaviour consists of drawing the window coverings, such as drapes, blinds or shutters to reduce heat loss in winter. The REUS 2008 determined that 69% of survey respondents do this, while 31% do not.

The savings associated with the behaviour were estimated to be approximately 5% of the space heating load.

A summary of the applicable data assumptions for this behaviour is provided below.

Assumptions Used for Analysis	
Applicable dwelling type	All detachments
Applicable end use	Space heating
Estimated unused energy services	1.6%
Eligible population	31%

Reduce Opening Windows in Winter

This behaviour consists of reducing the practice of opening windows during the winter to improve ventilation. The REUS 2008 determined that, on average, 25% of FortisBC customers “always” or “usually” open windows during the winter.

The savings associated with the behaviour were estimated to be approximately 5% of the space heating load.

A summary of the applicable data assumptions for this behaviour is provided below.

Assumptions Used for Analysis	
Applicable dwelling type	All detachments
Applicable end use	Space heating
Estimated unused energy services	1.3%
Eligible population	25%

6.2.2 *Domestic Hot Water*

DHW heating accounts for about 19% of residential natural gas consumption in the Base Year. The following behaviours were identified where the waste of hot water could be reduced through behaviour change:

- Turning off the water heater when on vacation
- Reducing the temperature of the hot water in the tank
- Increasing the share of laundry done with cold water
- Reducing shower length to five minutes.

Turn Off Water Heater When on Vacation

This behaviour applies to all dwellings with natural gas water heating. Seven percent of the natural gas used by a hot water tank is for standby losses or the heat loss through the tank walls while the water is being stored. This latter loss can be addressed by using a water heater blanket. However, it can be further reduced during absences from the house by turning off the water tank. The REUS 2008 reported that 30% of FortisBC customers currently practice this behaviour.

For the purpose of this analysis, we have assumed that the tank can be turned off for three weeks per year, reducing standby losses for the period.

A summary of the applicable data assumptions for this behaviour is provided below.

Assumptions Used for Analysis	
Applicable dwelling type	All detachments – natural gas water heating
Applicable end use	Natural gas DHW
Estimated unused energy shares	0.3%
Eligible population	70%

Reduce the Temperature of the Hot Water Tank

This behaviour applies to all residents with a natural gas hot water tank. The behaviour consists of checking the temperature of the hot water tank and reducing it by 4°C, thereby reducing standby losses.

The REUS 2008 reported that 50% of FortisBC customers have checked the temperature setting of their water tank and, of those customers, 46% subsequently lowered the temperature, 9% increased the temperature, and 46% left it unchanged. Natural gas water tank temperatures are typically set by plumbers at the time of installation; consequently, it is not known for certain why the 46% of customers left their temperature unchanged (i.e., what the actual temperature was). Hence, in the absence of more detailed data, this analysis assumes that the eligible population is the 50% of FortisBC customers who have not checked their hot water tank temperature. It further assumes that 50% of those customers will be able to reduce the temperature of the hot water tank by 4°C.

A summary of the applicable data assumptions for this behaviour is provided below.

Assumptions Used for Analysis	
Applicable dwelling type	All detachments – natural gas water heating
Applicable end use	Natural gas DHW
Estimated unused energy shares	0.4 %
Eligible population	25%

Increase Share of Laundry Done with Cold Water

This behaviour consists of encouraging FortisBC customers to increase the share of laundry done with cold water, thereby eliminating DHW usage for hot and warm water washes. The 2009 REUS estimated that FortisBC customers currently use cold water for 58% of their laundry. As technically it is possible with modern detergents to use cold water for 100% of laundry, the eligible population is the 42% customers who do not currently follow this practice.

The savings estimate is based on having all clothes washing done in cold water. As clothes washing accounts for 27% of the DHW usage, the potential savings are 27%.

Assumptions Used for Analysis	
Applicable dwelling type	All detachments – natural gas water heaters
Applicable end use	DHW
Estimated unused energy services	27%
Eligible population	42%

Five-Minute Shower

This behaviour consists of reducing the average per-person shower length, as reported in the 2008 REUS, from the average time for all FortisBC customers of 8.2 minutes to five minutes. The REUS further estimated that the eligible population for this measure was 22% of FortisBC customers.

The savings estimate assumes that showers account for approximately 24% of DHW usage and that the five-minute shower time represents a 39% reduction in DHW shower usage.

A summary of the applicable data assumptions for this behaviour is provided below.

Assumptions Used for Analysis	
Applicable dwelling type	All detachments – natural gas water heaters
Applicable end use	DHW
Estimated unused energy services	10%
Eligible population	22%

6.3 Potential Savings

Exhibit 23 and Exhibit 24 show the unbundled savings potential for, respectively, space heating and DHW behaviours.

Exhibit 23 Unbundled Savings Potential, Total FortisBC Service Area – Space Heating

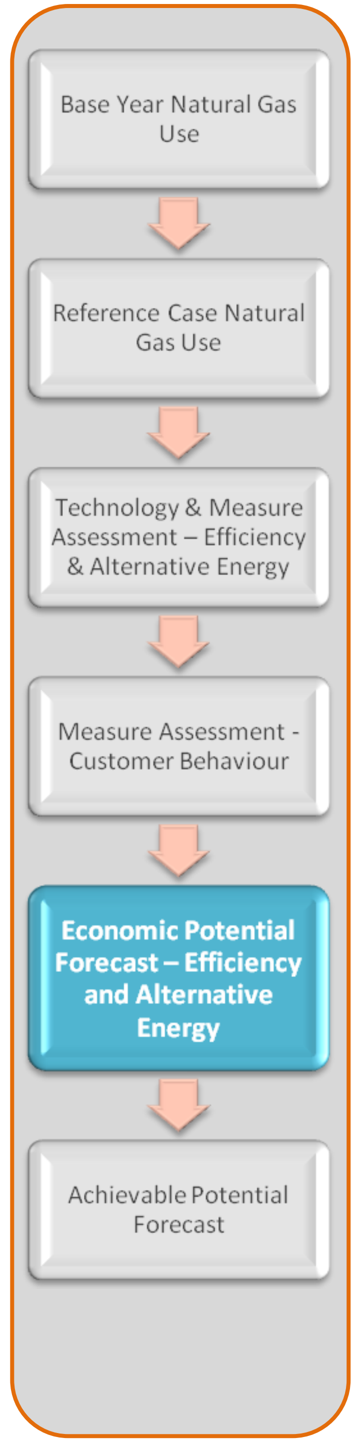
End Use & Dwelling Type	Base Year Consumption (1000 GJ/yr.)	Behaviour Measure	Unused Energy Services (% of Base Year)	Eligible Population	Unbundled Potential (1000 GJ/yr.)	Share of End Use
SFD	43,878	Temperature Setback	0.8%	17%	366	0.8%
Row	2,297	Over Night	0.8%	17%	19	0.8%
Mobile/other	861		0.8%	17%	7	0.8%
Sub-total	47,036				392	0.8%
SFD	43,878	Temperature Setback	0.9%	30%	403	0.9%
Row	2,297	when away during day	0.9%	30%	21	0.9%
Mobile/other	861		0.9%	30%	8	0.9%
Sub Total	47,036				432	0.9%
SFD	43,878	Heat Occupied	1.7%	15%	737	1.7%
Row	2,297	Parts of House Only	1.7%	15%	39	1.7%
Mobile/other	861		1.7%	15%	14	1.7%
Sub Total	47,036				790	1.7%
SFD	43,878	Maintain	1.7%	34%	746	1.7%
Row	2,297	Weather stripping	1.7%	34%	39	1.7%
Mobile/other	861		1.7%	34%	15	1.7%
Sub Total	47,036				800	1.7%
SFD	43,878	Install	1.2%	25%	509	1.2%
Row	2,297	Storm Windows	1.2%	25%	27	1.2%
Mobile/other	861		1.2%	25%	10	1.2%
Sub-total	47,036				546	1.2%
SFD	43,878	Close Blinds & shades	1.6%	23%	680	1.6%
Row	2,297	during space heat season	1.6%	23%	36	1.6%
Mobile/other	861		1.6%	23%	13	1.6%
Sub Total	47,036				729	1.6%
End Use Sub Total					3,688	7.8%

Exhibit 24 Unbundled Savings Potential, Total FortisBC Service Area – DHW

End Use & Dwelling Type	Base Year Consumption (1000 GJ/yr.)	Behaviour Measure	Unused Energy Services (% of Base Year)	Eligible Population	Maximum Saturation (% of End Use)	Unbundled Potential (1000 GJ/yr.)	Share of End Use
SFD	12,807	Turn off Water Heater	0.32%	70%	100%	42	0%
Row	1,103	when on vacation	0.32%	70%	100%	4	0%
Mobile/other	324		0.32%	70%	100%	1	0%
Sub Total	14,234					46	0%
SFD	12,807	Reduce Temperature	0.43%	70%	100%	55	0%
Row	1,103	of Tank	0.43%	70%	100%	5	0%
Mobile/other	324		0.43%	70%	100%	1	0%
Sub Total	14,234					61	0%
SFD	12,807	Minimize Hot	27.00%	27%	100%	934	7%
Row	1,103	and Warm Water Wash	27.00%	27%	100%	80	7%
Mobile/other	324		27.00%	27%	100%	24	7%
Sub Total	14,234					1,038	7%
SFD	12,807	Reduce Shower Length	9.80%	22%	100%	1,255	10%
Row	1,103		9.80%	22%	100%	108	10%
Mobile/other	324		9.80%	22%	100%	32	10%
Sub Total	14,234					1,395	10%
End Use Sub Total						2,540	18%

7 Economic Potential Forecast

7.1 Introduction



This section presents the Residential sector Economic Potential Forecast for the study period (2010 to 2030). The Economic Potential Forecast estimates the level of natural gas consumption that would occur if all building systems and equipment were upgraded to the level that is cost effective. In this study, "cost effective" means that the technology upgrade passes the measure TRC test, as discussed in Section 5.

The discussion in this section is organized into the following subsections:

- Major modelling tasks
- Technologies included in Economic Potential Forecast
- Presentation of results.

7.2 Major Modelling Tasks

By comparing the results of the Residential sector Economic Potential Forecast with the Reference Case, it is possible to determine the aggregate level of potential natural gas savings within the Residential sector, as well as to identify which specific building segments, end uses and technologies can provide the most significant opportunities for savings.

To develop the Residential sector Economic Potential Forecast, the following tasks were completed:

- The measure TRC results for each of the energy-efficiency upgrades presented previously in Exhibit 20 and Exhibit 21 were reviewed.

- Technology upgrades that had positive measure TRC results were selected for inclusion either on a "full-cost" or "incremental" basis. Technical upgrades passing the measure TRC test on a full-cost basis were implemented in the first forecast year. Those upgrades that only passed the measure TRC test on an incremental basis were introduced as the existing stock reached the end of its useful life. If more than one cost-effective measure existed for the same end-use application, the study selected the most energy-efficient one.

- Energy use within each of the dwelling types was modelled with the same energy models that were used to generate the Reference Case. However, for this forecast, the remaining standard efficiency technologies included in the Reference Case were replaced with the most efficient technology upgrade option that passed the measure TRC test.

- When more than one upgrade option was applied to a given end use, the first measure selected was the one that reduced the energy load. For example, measures to reduce the overall DHW load (e.g., ultra low-flow showerheads and more efficient dishwashers) would be applied before a high-efficiency water heater.

7.3 Technologies Included in Economic Potential Forecast

Exhibit 25 provides a listing of the technologies selected for inclusion in the Economic Potential Forecast. In each case, the exhibit shows the following:

- End use affected
- Upgrade option(s) selected
- Dwelling types to which the upgrade options were applied
- Rate at which the upgrade options were introduced into the stock.

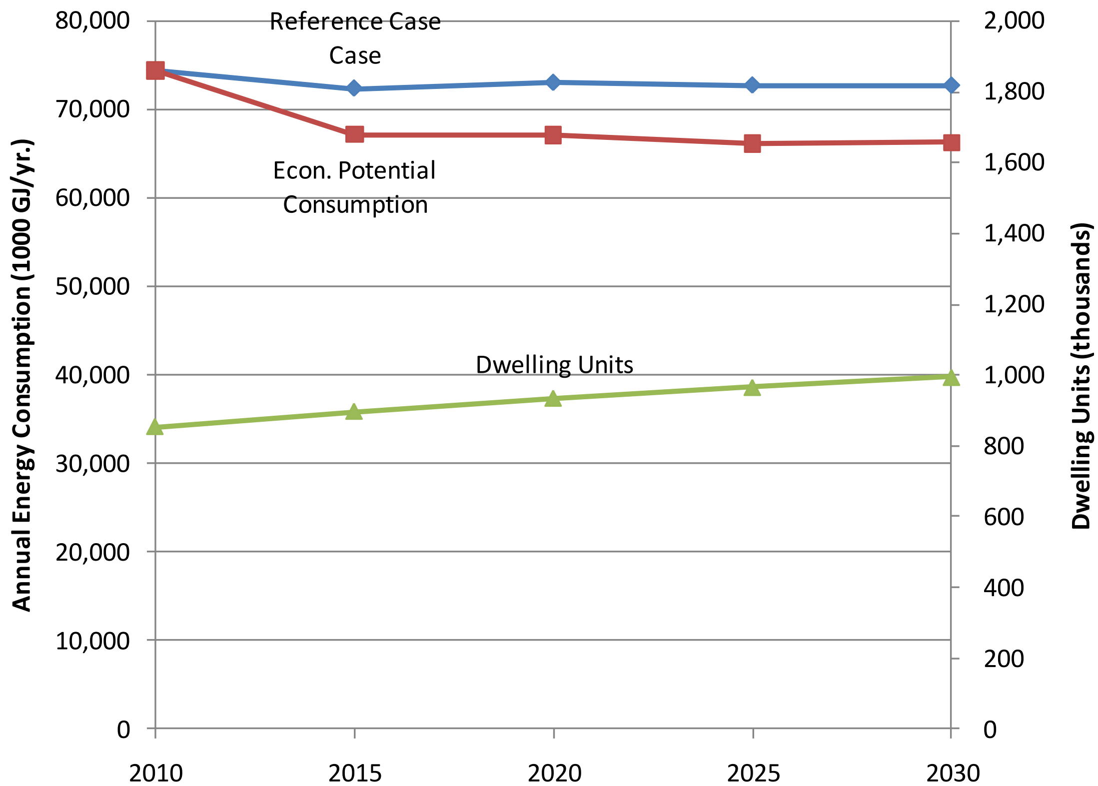
Exhibit 25 Technologies Included in Economic Potential

End Use	Upgrade Option	Applicability of Upgrade Options by Dwelling Type	Rate of Stock Introduction
Space Heating	High-performance glazing	▪ New and existing, all dwelling types	▪ New construction, immediate ▪ Existing, at rate of window replacement
	Attic, wall, and basement insulation	▪ Existing detached and attached	▪ At rate of renovation for other reasons
	Homeowner air sealing	▪ Existing, all dwelling types	▪ Immediate
	Programmable thermostats	▪ All	▪ Immediate
DHW	Savings from new clothes washers	▪ All	▪ See below for appliances
	Ultra low-flow showerheads and faucet aerators	▪ All	▪ Immediate
	DHW pipe insulation	▪ All existing	▪ Immediate
	DHW tank insulation	▪ All	▪ Immediate
Appliances	ENERGY STAR® clothes washers	▪ All	▪ Existing stock, at turnover ▪ New stock, immediate
Pools	Solar pool heaters	▪ All homes with pools	▪ At rate of heater replacement
Fireplace	High-efficiency fireplaces	▪ All existing or new homes with fireplaces	▪ As replaced or installed in new construction

7.4 Presentation of Results

Exhibit 26 compares the Reference Case and Economic Potential Forecast levels of residential energy consumption. As illustrated, under the Reference Case, residential natural gas consumption would decline slightly from the Base Year level of approximately 74 million GJ/yr. to 73 million GJ/yr. by 2030. This contrasts with the Economic Potential Forecast in which natural gas consumption would decrease to approximately 66 million GJ/yr. This is a difference of approximately 6.4 million GJ/yr., or about 9%.

Exhibit 26 Reference Case versus Economic Potential - Natural Gas Consumption for the Total FortisBC Service Area (1000 GJ/yr.)[18]



7.4.1 *Natural Gas Savings*

Further detail on the total potential natural gas savings provided by the Economic Potential Forecast is provided in the following exhibits:

- Exhibit 27 presents the results for the total FortisBC service area by service region and milestone year.
- Exhibit 28 presents the results for the total FortisBC service area by dwelling type and milestone year.
- Exhibit 29 presents the results for the total FortisBC service area by end use and milestone year.
- Exhibit 30 presents the results for the total FortisBC service area by technology and milestone year.

[18] The graph shows a large fraction of the Economic Potential savings occurring in the first milestone period. This is because a significant number of measures are cost effective at full cost and could theoretically be implemented immediately.

Exhibit 27 Natural Gas Savings for the Total FortisBC Service Area by Service Region and Milestone Year (1000 GJ/yr.)

Year	Lower Mainland	Northern Interior	Southern Interior	Vancouver Island	Whistler	Grand Total	% Savings Relative to Ref Case
2015	3,792	734	439	231	13	5,209	7%
2020	4,263	851	485	301	17	5,917	8%
2025	4,686	957	532	378	20	6,574	9%
2030	4,479	1,039	494	368	21	6,401	9%
Savings 2030 Relative to Ref Case	9%	13%	6%	7%	10%	9%	
Percentage of 2030 Savings by Region	70%	16%	8%	6%	0.3%	100%	

Exhibit 28 Natural Gas Savings for the Total FortisBC Service Area by Dwelling Type and Milestone Year (1000 GJ/yr.)

Dwelling Type	2015	2020	2025	2030	% Savings 2030 Relative to Ref Case	% Savings 2030 Relative to Total 2030 Savings
SFD/Duplex, gas heat, pre-1976	2,622	2,926	3,200	3,197	12%	50%
SFD/Duplex, gas heat, 1976 or newer	2,091	2,401	2,687	2,551	7%	40%
SFD/Duplex, non-gas heat, pre-1976	66	83	99	91	10%	1%
SFD/Duplex, non-gas heat, 1976 or newer	97	132	169	164	11%	3%
Attached/Row, gas heat, pre-1976	34	36	38	34	6%	1%
Attached/Row, gas heat, 1976 or newer	213	243	275	261	6%	4%
Attached/Row, non-gas heat, pre-1976	1	2	2	2	10%	0%
Attached/Row, non-gas heat, 1976 or newer	11	15	20	20	10%	0%
Mobile/other, gas heat	71	75	80	76	6%	1%
Mobile/other, non-gas heat	3	3	4	4	9%	0%
Grand Total	5,209	5,917	6,574	6,401	9%	100%

Note: Any difference in totals is due to rounding.

Exhibit 29 Natural Gas Savings for the Total FortisBC Service Area by End Use and Milestone Year (1000 GJ/yr.)

End Use	2015	2020	2025	2030	% Savings 2030 Relative to Ref Case	% Savings 2030 Relative to Total 2030 Savings
Space heating	2,633	2,761	2,867	2,953	7%	46%
Fireplace	645	1,348	2,097	2,094	18%	33%
Domestic hot water (DHW)	1,308	1,164	949	684	6%	11%
Pool & spa heaters	620	638	653	667	48%	10%
Clothes dryer	3	6	8	4	2%	0%
Grand Total	5,209	5,917	6,574	6,401	9%	100%

Note: DHW savings include savings from reduced DHW consumption by efficient clothes washers. Any difference in totals is due to rounding.

Exhibit 30 Natural Gas Savings for the Total FortisBC Service Area by Technology and Milestone Year (1000 GJ/yr.)

End Use	Measure	2015	2020	2025	2030	% Savings 2030 Relative to Total 2030 Savings	Average B/C Ratio
Domestic hot water (DHW)	DHW Pipe Insulation	67	64	58	54	1%	17.08
Domestic hot water (DHW)	Showerheads	729	604	461	347	5%	9.73
Space heating	Prog. Thermostats	1,173	1,003	830	657	10%	7.00
Domestic hot water (DHW)	Faucet Aerators	432	357	272	204	3%	5.10
Fireplace	Gas Fireplaces	645	1,348	2,097	2,094	33%	3.46
Pool & spa heaters	Solar Pool Heaters	620	638	653	667	10%	1.25
Space heating	Wall Insulation	89	173	253	329	5%	1.17
Domestic hot water (DHW)	DHW Tank Insulation	15	14	14	13	0%	1.16
Space heating	Attic Insulation	468	453	438	424	7%	1.15
Space heating	Basement Insulation	264	512	744	960	15%	1.10
Space heating	Homeowner Air Sealing	640	621	602	583	9%	1.08
Domestic hot water (DHW)	ESTAR Clothes Washers	68	131	153	70	1%	1.02
Grand Total		5,209	5,917	6,574	6,401	100%	3.23

Note: Any difference in totals is due to rounding.

The average benefit-cost ratios in Exhibit 30 differ from those presented in Exhibit 21 because these ratios are based on the tallied ratios for all combinations of dwelling types and regions *where the measure passes*. The ratios presented in Exhibit 21 were based on the Lower Mainland region only and averaged all the applicable dwelling types, whether or not the measure passed.

7.4.2 *Interpretation of Results*

Highlights of the potential natural gas savings presented in the preceding exhibits are summarized below.

Savings by Service Region

The Lower Mainland service region represents 70% of the identified savings. This is consistent with the fact that the Lower Mainland is expected to account for 69% of FortisBC customers in 2030. The Northern Interior region represents 16% of the identified savings, which is disproportionately large compared to its expected 10% share of FortisBC customers in 2030. The Southern Interior represents 8% of savings, much lower than its expected 17% of FortisBC customers by 2030, and Vancouver Island represents 6% of savings, also much lower than its expected 14% share of customers.

In the Northern Interior region, potential savings are 13% of the Reference Case consumption in 2030, the highest percentage of any of the regions. In the Whistler region, potential savings are 10% of the Reference Case consumption in 2030 and in the Lower Mainland savings are 9% of Reference Case consumption in 2030. In the Southern Interior and Vancouver Island regions, potential savings are only 6% and 7% of Reference Case consumption in 2030, respectively.

The Southern Interior and Vancouver Island regions have lower potential savings primarily because they use less gas per customer in the Reference Case. End uses such as space heating account for less gas consumption in these regions, so many measures are less attractive financially.

Savings by Milestone Year

Eighty-one percent of the total identified Economic Potential savings are economically feasible by 2015. This is because a number of measures are cost effective at full cost (i.e., it is economically attractive to implement them immediately). Therefore, they are implemented right away under the Economic Potential scenario.

The expected impact of natural conservation in the Residential sector is also an important factor that causes 2015 savings to be relatively large in proportion to the total 2030 savings. Savings are calculated based on the expected difference between the Reference Case (which includes savings from natural conservation) and the Economic Potential Forecast. As naturally-occurring savings gradually increase over the study period they erode some of the Economic Potential.

Savings by Dwelling Type

Single-family dwellings account for approximately 94% of the potential savings; this reflects their larger market share and their generally higher level of energy intensity per dwelling.

Savings by End Use

Space heating accounts for approximately 46% of the total energy savings in the Economic Potential Forecast. The largest contributor to these savings is basement insulation, followed by programmable thermostats, homeowner air sealing, wall insulation, and attic insulation.

Fireplaces account for approximately 33% of total energy savings in the Economic Potential Forecast. These savings are all from upgrading to more efficient fireplaces at the natural rate of replacement or new purchase.

DHW accounts for approximately 11% of the total energy savings in the Economic Potential Forecast. There are several significant DHW energy-saving measures that are economically attractive, including ultra low-flow showerheads, faucet aerators, efficient clothes washers, hot water pipe insulation, and hot water tank insulation.

Swimming pool and spa heaters account for approximately 10% of the total savings in the Economic Potential Forecast. These savings are from solar pool heaters.

Clothes dryers account for less than 1% of the total savings in the Economic Potential Forecast. These savings result from the faster spin cycles of efficient clothes washers.[19]

7.4.3 *Electricity Savings*

Implementation of the natural gas efficiency measures contained in the Economic Potential Forecast would also result in electricity savings. For example, measures that improve the building envelope (such as efficient windows) also reduce furnace runtime, thereby saving ventilation fan energy. Similarly, ENERGY STAR® clothes washers use less electricity and less hot water.

Further detail on the potential electricity savings provided by the Economic Potential Forecast is provided in the following exhibits:

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[19] The faster spin cycle in an efficient washer removes more water from the clothing, so that the time required to dry the clothes is reduced by approximately 35%.

- Exhibit 31 presents the results by service region and milestone year.
- Exhibit 32 presents the results for the total FortisBC service area by dwelling type and milestone year.
- Exhibit 33 presents the results for the total FortisBC service area by end use and milestone year.
- Exhibit 34 presents the results for the total FortisBC service area by technology and milestone year.

Exhibit 31 Electricity Savings by Service Region and Milestone Year (MWh/yr.)

Year	Lower Mainland	Northern Interior	Southern Interior	Vancouver Island	Whistler	Grand Total
2015	11,443	3,292	2,510	225	26	17,496
2020	13,996	4,444	2,236	214	44	20,934
2025	15,917	5,592	1,920	192	60	23,680
2030	15,544	6,737	1,577	165	70	24,092
Percentage of 2030 Savings by Region	65%	28%	7%	1%	0.3%	

Note: Any difference in totals is due to rounding.

Exhibit 32 Electricity Savings for the Total FortisBC Service Area by Dwelling Type and Milestone Year (MWh/yr.)

Dwelling Type	2015	2020	2025	2030	% Savings 2030 Relative to Total 2030 Savings
SFD/Duplex, gas heat, pre-1976	11,550	13,759	15,712	16,780	69.7%
SFD/Duplex, gas heat, 1976 or newer	5,525	6,684	7,455	6,924	28.7%
SFD/Duplex, non-gas heat, pre-1976	38	69	83	40	0.2%
SFD/Duplex, non-gas heat, 1976 or newer	50	94	118	58	0.2%
Attached/Row, gas heat, pre-1976	36	37	38	39	0.2%
Attached/Row, gas heat, 1976 or newer	191	181	164	141	0.6%
Attached/Row, non-gas heat, pre-1976	-	-	-	-	0.0%
Attached/Row, non-gas heat, 1976 or newer	-	-	-	-	0.0%
Mobile/other, gas heat	107	109	110	110	0.5%
Mobile/other, non-gas heat	-	-	-	-	0.0%
Grand Total	17,496	20,934	23,680	24,092	100.0%

Note: Any difference in totals is due to rounding.

Exhibit 33 Electricity Savings for the Total FortisBC Service Area by End Use and Milestone Year (MWh/yr.)

End Use	2015	2020	2025	2030	% Savings 2030 Relative to Total 2030 Savings
Ventilation and Circulation	12,792	15,321	17,821	20,302	84.3%
Space cooling	3,282	2,961	2,594	2,198	9.1%
Clothes washer	1,422	2,652	3,265	1,592	6.6%
Grand Total	17,496	20,934	23,680	24,092	100.0%

Note: Any difference in totals is due to rounding.

Exhibit 34 Electricity Savings for the Total FortisBC Service Area by Technology and Milestone Year (MWh/yr.)

Measure	2015	2020	2025	2030	% Savings 2030 Relative to Total 2030 Savings
Basement Insulation	2,061	4,117	6,170	8,221	34.1%
Homeowner Air Sealing	4,813	4,807	4,803	4,799	19.9%
Prog. Thermostats	4,693	4,169	3,573	2,931	12.2%
Attic Insulation	3,820	3,816	3,813	3,810	15.8%
ESTAR Clothes Washers	1,422	2,652	3,265	1,592	6.6%
Wall Insulation	687	1,372	2,055	2,738	11.4%
Grand Total	17,496	20,934	23,680	24,092	100.0%

7.4.4 *Caveats on Interpretation of Results*

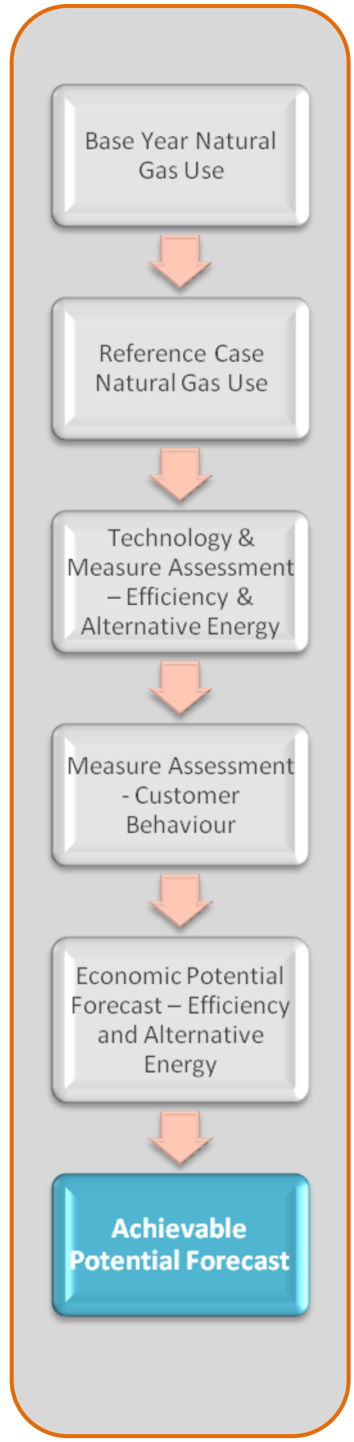
A systems approach was used to model the energy impacts of the efficiency upgrades presented in the preceding section. In the absence of a systems approach, there would be double counting of savings and an accurate assessment of the total contribution of the energy-efficient upgrades would not be possible.

For example, programmable thermostats reduce space heating natural gas use, as does the installation of new energy-efficient windows. On its own, each measure will reduce overall space heating energy use. However, the two savings are not cumulative. The order in which some upgrades are introduced is also important. In this study, the approach has been to select and model the impact of measures that reduce the load for a given end use (e.g., wall insulation or window upgrades that reduce the space heating load) and then to introduce measures that meet the remaining load more efficiently (e.g., a high-efficiency space heating system).

The above approach means that where there is interaction between measures that affect the same end use, the savings for the individual measures shown in Exhibit 30 are reduced. For example, if the programmable thermostat measure were implemented in the absence of any other space heating measures, its savings would be greater than those shown in Exhibit 30. As appropriate, this issue is addressed in Section 8 of this report.

8 Achievable Potential Forecast

8.1 Introduction



This section presents the Residential sector Achievable Potential for the study period (2010 to 2030). The Achievable Potential is defined as the proportion of the energy-efficiency opportunities identified in the Economic Potential Forecast that could realistically be achieved within the study period.

The remainder of this discussion is organized into the following subsections:

- Description of Achievable Potential
- Approach to the estimation of Achievable Potential
- Results – energy-efficient technologies.

8.2 Description of Achievable Potential

Achievable Potential recognizes that, in many instances, it is difficult to induce all customers to purchase and install all the energy-efficiency technologies that meet the criteria defined by the Economic Potential Forecast. For example, customer decisions to implement energy-efficient measures can be constrained by important factors such as:

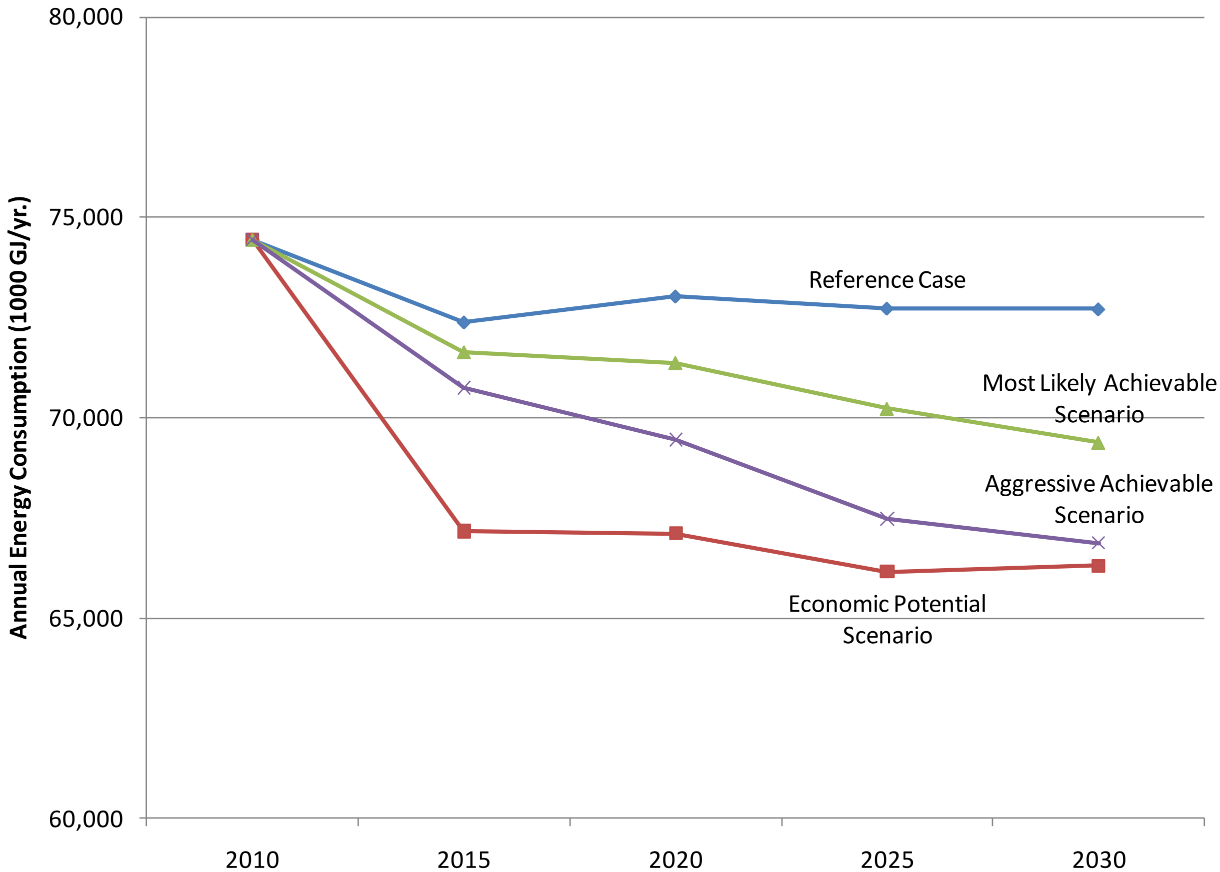
- Higher first cost of efficient product(s)
- Need to recover investment costs in a short period (payback)
- Lack of product performance information
- Lack of product availability.

The rate at which customers accept and purchase energy-efficient products will be influenced by the level of financial incentives, information and other measures put in place by FortisBC, BC Hydro, governments and the private sector to remove barriers such as those noted above.

Exhibit 35 presents the levels of natural gas consumption that are estimated in the Achievable Potential scenario. As illustrated, the Achievable Potential scenarios are *banded* by the two forecasts presented in previous sections, namely the Economic Potential Forecast and the Reference Case.

As illustrated in Exhibit 35 energy savings under the Achievable Potential scenario are less than in the Economic Potential Forecast. In this CPR, the primary factor that contributes to the outcome shown in Exhibit 35 is the rate of market penetration. In the Economic Potential Forecast, efficient new technologies are assumed to fully penetrate the market as soon as it is economically attractive to do so. However, the Achievable Potential recognizes that under real world conditions, the rate at which customers are likely to implement new technologies will be influenced by additional practical considerations and will, therefore, occur more slowly than under the assumptions employed in the Economic Potential Forecast.

Exhibit 35 Annual Natural Gas Consumption—Energy-efficiency Achievable Potential Relative to Reference Case and Economic Potential Forecast for the Residential Sector (1000 GJ/yr.)



As also illustrated in Exhibit 35, the Achievable results are presented as a band of possibilities, rather than a single line. This is because any estimate of Achievable Potential over a 20-year period is necessarily subject to uncertainty. Consequently, two Achievable Potential scenarios are presented: *most likely* and *aggressive*.

The *most likely* Achievable Potential assumes British Columbia market conditions that are similar to those contained in the Reference Case. That is, customers' awareness of energy-efficiency options and their motivation levels remain similar to those in the recent past, technology improvements continue at historical levels, and new energy performance standards continue as per current known schedules. It also assumes that FortisBC's ability to influence customers' decisions towards increased investments in energy-efficiency options remains roughly in line with previous company DSM experience.

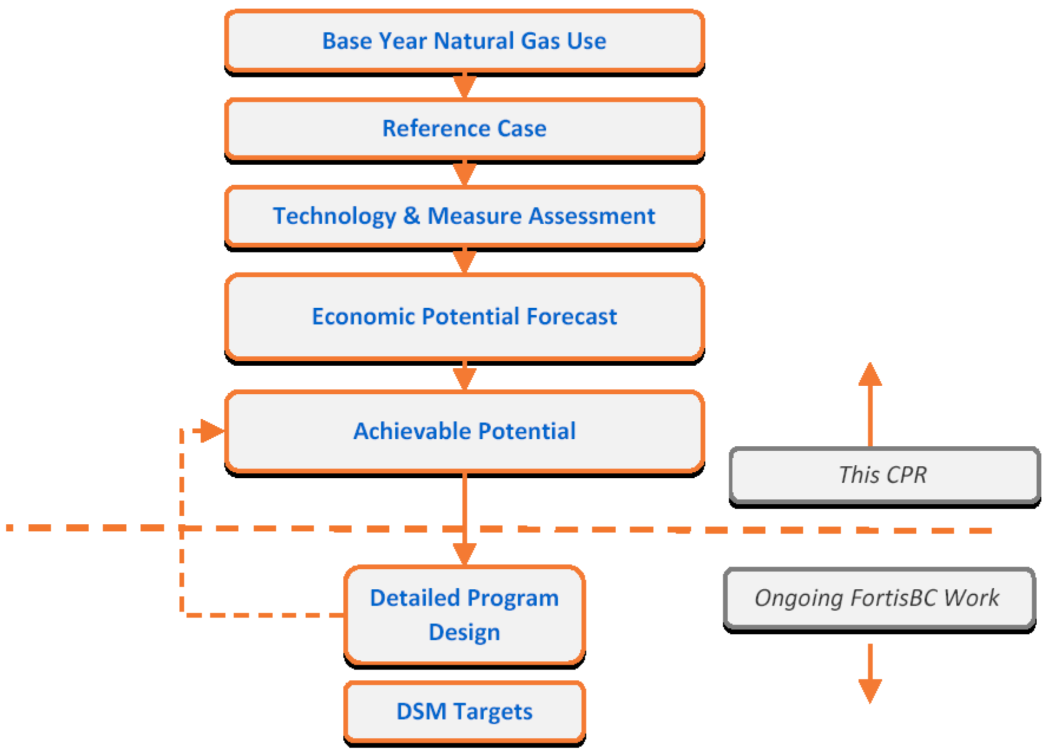
The *aggressive* Achievable Potential assumes British Columbia market conditions that aggressively support investment in energy efficiency. For example, this scenario assumes that real energy prices increase over the study period and that federal and provincial government actions to mitigate climate change result in increased levels of complementary energy-efficiency initiatives. *Aggressive* Achievable Potential typically does not reach Economic Potential levels; this recognizes that some portion of the market is typically constrained by barriers that cannot realistically be affected by DSM programs within the study period.

8.2.1 *Achievable Potential Versus Detailed Program Design*

It should also be emphasized that the estimation of Achievable Potential is not synonymous with either the setting of specific program targets or with program design. While both are closely linked to the discussion of Achievable Potential, they involve more detailed analysis that is beyond the scope of this study.

Exhibit 36 illustrates the relationship between Achievable Potential and the more detailed program design.

Exhibit 36 Achievable Potential versus Detailed Program Design



8.3 Approach to the Estimation of Achievable Potential

Achievable Potential was estimated in a five-step approach.

- Priority opportunities were selected
- Opportunity profiles were created
- Opportunity worksheets were prepared
- A full-day workshop was held
- Workshop results were aggregated and applied to the remaining opportunities.

Further discussion is provided below.

8.3.1 *Step 1: Select Priority Opportunities*

The first step in developing the Achievable Potential estimates required selecting the energy saving opportunities identified in the Economic Potential Forecast to be discussed during the Achievable workshop. Several criteria determined selection, including:

- The priority measures should represent a substantial fraction of the overall Economic Potential
- The priority measures should represent several different energy end uses
- The priority measures should have a variety of different likely patterns of market adoption so the discussions will be widely varied.

A summary of the selected energy-efficiency actions, along with the approximate percentage that it represents in the Economic Potential, is provided in Exhibit 37.

Exhibit 37 Residential Sector Actions – Energy Efficiency

Action Profile #	Measure	End Use	% Savings 2030 Relative to Total 2030 Savings
R1	Gas Fireplaces	Fireplace	33%
R2	Basement Insulation	Space heating	15%
R3	Solar Pool Heaters	Pool & spa heaters	10%
R4	Showerheads	Domestic hot water (DHW)	5%
R6	Attic Insulation	Space heating	7%
Grand Total			70%

In addition to these measures, early retirement of gas furnaces (R5) was included in the Achievable Potential at the request of FortisBC. This is because, although the measure is not considered cost effective when viewed through conventional DSM screens (it does not pass the TRC test as applied in this study), fully 76% of FortisBC's customers (or 91% of those who heat with gas furnaces) have standard- and mid-efficiency furnaces. It is the desire of FortisBC to offer its customers a program to encourage these customers to replace their standard- and mid-efficiency furnaces at or before the end of equipment life with high-efficiency furnaces. Thus, FortisBC wanted to discover through this study the impacts of such a program on the savings available from the Residential sector.[20]

8.3.2 *Step 2: Create Opportunity Profiles*

The next step involved the development of brief profiles for each of the opportunities noted above in Exhibit 37, in the form of four or five PowerPoint slides. The slides are presented in Appendix D.

The purpose of the opportunity profiles was to provide a high-level logic framework that would serve as a guide for participant discussions in the Achievable workshop (see Section 8.3.3 below). The intent was to define a broad rationale and direction without getting into the much greater detail required of program design, which, as noted previously, is beyond the scope of

[20] In principle, the same approach can also be applied to residential DHW tanks. New regulations have increased the minimum efficiency of new tanks but many customers have old, inefficient tanks that are not due for replacement for several years.

this project. As illustrated in Appendix D, each opportunity profile addresses the following areas:

Technology Description – provides a summary statement of the broad goal and rationale for the Action.

Target Dwelling Type and Typical Application – highlights the dwelling types and applications that offer the most significant opportunities and which provide a good starting point for a discussion of the technology.

Financial and Economic Indicators – provides estimates of average simple payback, benefit-cost ratio (TRC analysis), and basis of assessment (full cost versus incremental).

Eligible Participants – provides an estimate of the number of dwellings or appliances that could be affected during the study period if the entire Economic Potential were to be captured.

Economic Potential versus Time – shows the pattern of the changing size of the opportunity over the study period, for existing and new dwellings. Some opportunities grow steadily through the study period, as more and more appliances reach the age when they would be replaced. Other opportunities are economic to capture immediately, and after that the growth over time is limited to opportunities in new dwellings being built. Still other opportunities decline with time as they are eroded by natural conservation activities.

Economic Potential versus Dwelling Type and Region – shows how the opportunity is distributed through FortisBC's service area.

8.3.3 *Step 3: Prepare Opportunity Worksheets*

A draft assessment worksheet was prepared for each opportunity profile in advance of the achievable workshop. The assessment worksheets complemented the information contained in the opportunity profiles by providing quantitative data on the potential energy savings for each opportunity as well as providing information on the size and composition of the eligible population of potential participants. Energy impacts and population data were taken from the detailed modelling results contained in the Economic Potential Forecast.

The worksheets, including the results recorded during the workshop discussions, are provided in Appendix E. As illustrated in Appendix E, each opportunity assessment worksheet addresses the following areas:

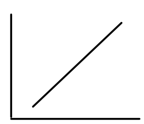
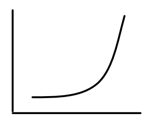
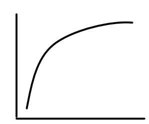
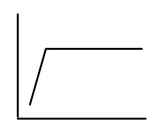
Approximate Benefit-Cost Ratio – shows the approximate ratio of economic benefits to costs. The benefit-cost ratio provides an indication of the relative economic attractiveness of the energy-efficiency measures from FortisBC's perspective. For the purposes of the workshop, this information provided participants with an indication of the scope for using financial incentives to influence customer participation rates.

Customer Payback – shows the simple payback from the customer's perspective for the package of energy-efficiency measures included in the opportunity. This information provided an indication of the level of attractiveness that the opportunity would present to customers. This provided an important reference point for the workshop participants when considering potential participation rates. When combined with the preceding benefit-cost information, participants were able to "roughly" estimate the level of financial incentives that could be employed to increase the opportunity's attractiveness to customers without making it economically unattractive to FortisBC**.**

Economic Potential in Terms of Applicable Participants (e.g., number of dwellings) – shows the total number of potential participants in terms of either dwellings or appliances (as appropriate) that could theoretically take part in the opportunity. Numbers shown are from the eligible populations used in the Economic Potential Forecast.

Participation Rates (%) – these fields were filled in during the workshops (described below in Step 4), based on input from the participants. They show the percentage of economic savings that workshop participants concluded could be achievable in the last milestone period (usually 2030, but may be earlier for measures that peak earlier). As noted in the introduction to this section, two achievable levels are shown: *most likely* and *aggressive*. For example, Exhibit 38 shows a participation rate of 29% (*most likely*) for high-efficiency fireplaces in existing detached homes by the year 2025. This means that an estimated 29% of the fireplaces being replaced in that year could be upgraded under a likely level of program activity. Under the comments column, participants indicated a likely shape for a curve to describe how quickly activity would rise to that level, so that participation rates for the intervening milestone years could be estimated. The different curves are shown in Exhibit 38.

Exhibit 38 Sample Participation Curves for Achievable Workshop

Curve A	Curve B	Curve C	Curve D
			

Achievable Potential in Terms of Applicable Participants (e.g., number of dwellings) – these fields were calculated by the spreadsheet based on the participation rates provided by the participants.

Participation Rates Relative to the Discussion Scenario – these fields were filled in during the workshops to provide guidance to the consulting team on how participation might differ in other regions or dwelling types.

Other Parameters – these fields were filled in during the workshop to capture other aspects of the discussion. In addition, the consulting team took notes on the discussion and summarized them in Appendix F.

8.3.4 *Step 4: Achievable Workshop*

The most critical step in developing the estimates of Achievable Potential was a one-day Achievable Potential workshop that was held on January 25, 2011. Workshop participants consisted of core members of the consultant team, DSM program and technical personnel from FortisBC, and industry representatives. Together, the participating personnel brought many years of experience to the workshop related to the technologies and markets as well as the design and delivery of energy-efficiency programs in British Columbia.

The purpose of this workshop was to:

- Promote discussion regarding the technical and market constraints confronting the identified energy-efficiency opportunities
- Identify potential strategies for addressing the identified constraints, including potential partners and delivery channels

- Compile participant views related to how much of the identified economic savings could realistically be achieved over the study period.

The discussion of each opportunity profile began with a brief consultant presentation. The floor was then opened to participant discussion of the key factors affecting each of the market segments and technical opportunities contained in the opportunity profile and accompanying worksheet.

Following discussion of the broad market and intervention conditions affecting the opportunity, workshop participant views were recorded on the *most likely* and *aggressive* customer participation rates. General agreement was sought on rates to be carried forward into the analysis.

As noted earlier, it was not possible to fully address all opportunities in the one-day workshop. Consequently, the workshop focused on opportunities selected based on the criteria described in Step 1. The consultants extrapolated to estimate participation for the remaining opportunities, consulting with FortisBC program personnel as needed. The values shown in the attached appendices and in the following summary tables incorporate the results of all these inputs.

8.3.5 *Step 5: Aggregate Opportunity Results*

The final step involved aggregating the results of the individual opportunities to provide a view of the Achievable Potential savings for the total Residential sector.

8.4 Results – Energy-efficient Technologies

A summary of the *most likely* and *aggressive* Achievable Potential results for the energy-efficiency opportunities is presented in this section. These results include the following:

- Natural gas consumption savings
- Peak day load impacts
- Greenhouse gas emission reductions.

8.4.1 *Natural Gas Consumption Savings – Aggressive Achievable Scenario*

The following exhibits present the potential natural gas savings under the *aggressive* Achievable Potential scenario. The results shown are relative to the Reference Case. The results are broken down as follows:

- Exhibit 39 presents the results for the total FortisBC service area by service region and milestone year.
- Exhibit 40 presents the results for the total FortisBC service area by dwelling type and milestone year.
- Exhibit 41 presents the results for the total FortisBC service area by end use and milestone year.
- Exhibit 42 presents the results for the total FortisBC service area by technology and milestone year.

Exhibit 39 Aggressive Achievable Natural Gas Savings for the Total FortisBC Service Area by Service Region and Milestone Year (1000 GJ/yr.)[21]

Year	Lower Mainland	Northern Interior	Southern Interior	Vancouver Island	Whistler	Grand Total	% Savings Relative to Ref Case
2015	1,158	261	163	54	4	1,640	2%
2020	2,533	555	360	120	6	3,574	5%
2025	3,737	781	526	203	5	5,252	7%
2030	4,098	936	572	225	5	5,836	8%
Savings 2030 Relative to Ref Case	8%	11%	7%	4%	2%	8%	
Percentage of 2030 Savings by Region	70%	16%	10%	4%	0.1%	100%	

Exhibit 40 Aggressive Achievable Natural Gas Savings for the Total FortisBC Service Area by Dwelling Type and Milestone Year (1000 GJ/yr.)

Dwelling Type	2015	2020	2025	2030	% Savings 2030 Relative to Ref Case	% Savings 2030 Relative to Total 2030 Savings
SFD/Duplex, gas heat, pre-1976	815	1,763	2,556	2,885	11%	49%
SFD/Duplex, gas heat, 1976 or newer	710	1,558	2,299	2,513	7%	43%
SFD/Duplex, non-gas heat, pre-1976	5	14	29	34	4%	1%
SFD/Duplex, non-gas heat, 1976 or newer	8	23	54	67	4%	1%
Attached/Row, gas heat, pre-1976	12	25	34	35	6%	1%
Attached/Row, gas heat, 1976 or newer	62	132	196	208	5%	4%
Attached/Row, non-gas heat, pre-1976	0	0	1	1	3%	0%
Attached/Row, non-gas heat, 1976 or newer	1	3	6	7	4%	0%
Mobile/other, gas heat	27	56	75	85	7%	1%
Mobile/other, non-gas heat	0	1	1	1	3%	0%
Grand Total	1,640	3,574	5,252	5,836	8%	100%

Note: Any difference in totals is due to rounding.

Exhibit 41 Aggressive Achievable Natural Gas Savings for the Total FortisBC Service Area by End Use and Milestone Year (1000 GJ/yr.)

End Use	2015	2020	2025	2030	% Savings 2030 Relative to Ref Case	% Savings 2030 Relative to Total 2030 Savings
Space heating	1,435	3,036	4,136	4,509	10%	77%
Fireplace	46	222	667	753	7%	13%
Domestic hot water (DHW)	136	224	238	195	2%	3%
Pool & spa heaters	22	90	207	377	27%	6%
Clothes dryer	1	3	4	3	1%	0%
Grand Total	1,640	3,574	5,252	5,836	8%	100%

Note: DHW savings include savings from reduced DHW consumption by efficient clothes washers. Any difference in totals is due to rounding.

[21] Exhibit 39, Exhibit 40, and Exhibit 41 include the savings associated with the early retirement of gas furnaces measure. The estimated savings of that measure are shown in Exhibit 42 and can be subtracted from the savings shown in the three exhibits above. The estimated 2030 Aggressive Achievable savings from the remaining measures would be approximately 4% of the Reference Case natural gas consumption in 2030.

Exhibit 42 Aggressive Achievable Natural Gas Savings for the Total FortisBC Service Area by Technology and Milestone Year (1000 GJ/yr.)

End Use	Measure	2015	2020	2025	2030	% Savings 2030 Relative to Total 2030 Savings	Average B/C Ratio
Domestic hot water (DHW)	DHW Pipe Insulation	22	36	41	41	1%	17.08
Domestic hot water (DHW)	Showerheads	55	78	75	60	1%	9.55
Space heating	Prog. Thermostats	396	580	599	505	9%	7.03
Domestic hot water (DHW)	Faucet Aerators	33	46	44	35	1%	5.00
Fireplace	Gas Fireplaces	46	222	667	753	13%	3.44
Pool & spa heaters	Solar Pool Heaters	22	90	207	377	6%	1.25
Space heating	Wall Insulation	16	48	92	149	3%	1.17
Domestic hot water (DHW)	DHW Tank Insulation	5	8	10	10	0%	1.16
Space heating	Attic Insulation	88	170	247	318	5%	1.15
Space heating	Basement Insulation	49	142	272	434	7%	1.10
Space heating	Homeowner Air Sealing	120	233	338	437	7%	1.08
Domestic hot water (DHW)	ESTAR Clothes Washers	22	58	73	52	1%	1.02
Space heating	Early Retire Gas Furnaces	766	1,864	2,588	2,668	46%	0.33
Grand Total		1,640	3,574	5,252	5,836	100%	1.80

Note: Any difference in totals is due to rounding.

8.4.2 *Natural Gas Consumption Savings – Most likely Achievable Scenario*

The following exhibits present the potential natural gas savings under the *most likely* Achievable Potential scenario. The results shown are relative to the Reference Case. The results are broken down as follows:

- Exhibit 43 presents the results for the total FortisBC service area by service region and milestone year.
- Exhibit 44 presents the results for the total FortisBC service area by dwelling type and milestone year.
- Exhibit 45 presents the results for the total FortisBC service area by end use and milestone year.
- Exhibit 46 presents the results for the total FortisBC service area by technology and milestone year.

Exhibit 43 Most Likely Achievable Natural Gas Savings for the Total FortisBC Service Area by Service Region and Milestone Year (1000 GJ/yr.)[22]

Year	Lower Mainland	Northern Interior	Southern Interior	Vancouver Island	Whistler	Grand Total	% Savings Relative to Ref Case	Additional % Savings Between Most Likely & Aggressive
2015	525	119	73	26	2	744	1%	1%
2020	1,173	259	165	58	3	1,658	2%	3%
2025	1,775	373	247	101	3	2,500	3%	4%
2030	2,369	504	330	124	2	3,329	5%	3%
Savings 2030 Relative to Ref Case	5%	6%	4%	2%	1%	5%		
Percentage of 2030 Savings by Region	71%	15%	10%	4%	0.1%	100%		

Exhibit 44 Most Likely Achievable Natural Gas Savings for the Total FortisBC Service Area by Dwelling Type and Milestone Year (1000 GJ/yr.)

Dwelling Type	2015	2020	2025	2030	% Savings 2030 Relative to Ref Case	Additional % Savings Between Most Likely & Aggressive	% Savings 2030 Relative to Total 2030 Savings
SFD/Duplex, gas heat, pre-1976	372	823	1,238	1,665	6%	5%	50%
SFD/Duplex, gas heat, 1976 or newer	318	716	1,074	1,425	4%	3%	43%
SFD/Duplex, non-gas heat, pre-1976	3	7	15	18	2%	2%	1%
SFD/Duplex, non-gas heat, 1976 or newer	4	12	29	37	2%	2%	1%
Attached/Row, gas heat, pre-1976	5	11	16	21	4%	3%	1%
Attached/Row, gas heat, 1976 or newer	28	61	90	117	3%	2%	4%
Attached/Row, non-gas heat, pre-1976	0	0	0	0	1%	2%	0%
Attached/Row, non-gas heat, 1976 or newer	1	1	3	4	2%	2%	0%
Mobile/other, gas heat	12	26	34	42	3%	3%	1%
Mobile/other, non-gas heat	0	0	1	1	1%	2%	0%
Grand Total	744	1,658	2,500	3,329	5%	3%	100%

Note: Any difference in totals is due to rounding.

Exhibit 45 Most Likely Achievable Natural Gas Savings for the Total FortisBC Service Area by End Use and Milestone Year (1000 GJ/yr.)

End Use	2015	2020	2025	2030	% Savings 2030 Relative to Ref Case	Additional % Savings Between Most Likely & Aggressive	% Savings 2030 Relative to Total 2030 Savings
Space heating	629	1,368	1,912	2,617	6%	4%	79%
Fireplace	23	111	336	391	3%	3%	12%
Domestic hot water (DHW)	79	128	134	110	1%	1%	3%
Pool & spa heaters	12	50	116	210	15%	12%	6%
Clothes dryer	0	1	2	2	1%	1%	0%
Grand Total	744	1,658	2,500	3,329	5%	3%	100%

Note: DHW savings include savings from reduced DHW consumption by efficient clothes washers. Any difference in totals is due to rounding.

[22] Exhibit 43, Exhibit 44, and Exhibit 45 include the savings associated with the Early Retirement of Gas Furnaces measure. The estimated savings of that measure are shown in Exhibit 46 and can be subtracted from the savings shown in the three exhibits above. The estimated 2030 Most Likely Achievable savings from the remaining measures would be approximately 2% of the reference case natural gas consumption in 2030.

Exhibit 46 Most Likely Achievable Natural Gas Savings for the Total FortisBC Service Area by Technology and Milestone Year (1000 GJ/yr.)

End Use	Measure	2015	2020	2025	2030	% Savings 2030 Relative to Total 2030 Savings	Average B/C Ratio
Domestic hot water (DHW)	DHW Pipe Insulation	11	18	20	20	1%	17.08
Domestic hot water (DHW)	Showerheads	35	49	47	38	1%	9.55
Space heating	Prog. Thermostats	198	292	303	256	8%	7.05
Domestic hot water (DHW)	Faucet Aerators	21	29	28	22	1%	5.00
Fireplace	Gas Fireplaces	23	111	336	391	12%	3.45
Pool & spa heaters	Solar Pool Heaters	12	50	116	210	6%	1.25
Space heating	Wall Insulation	8	24	46	74	2%	1.17
Domestic hot water (DHW)	DHW Tank Insulation	2	4	5	5	0%	1.16
Space heating	Attic Insulation	44	85	123	159	5%	1.15
Space heating	Basement Insulation	25	71	136	217	7%	1.10
Space heating	Homeowner Air Sealing	60	116	169	218	7%	1.08
Domestic hot water (DHW)	ESTAR Clothes Washers	11	29	36	26	1%	1.02
Space heating	Early Retire Gas Furnaces	294	780	1,134	1,693	51%	0.34
Grand Total		744	1,658	2,500	3,329	100%	1.68

Note: Any difference in totals is due to rounding.

8.4.3 *Peak Day Load Impacts – Energy-efficiency Scenarios*

This sub section estimates the peak day load impact that would occur as a result of the Achievable Potential scenarios presented in the preceding exhibits. Peak day load impact measures the relationship between a typical or average daily consumption rate and the consumption that occurs on a peak day when the demand for natural gas is at a maximum. The relationship is illustrated in the formula below.

$$\textit{Peak Day Consumption} = \frac{\textit{Average Daily Consumption}}{\textit{Load Factor}}$$

The following steps were employed to derive the estimated peak day load impacts:

- Annual natural gas decreases associated with each of the preceding Achievable Potential scenarios were identified (GJ/yr.).

FortisBC provided load factors that correlate the relationship between average and peak day consumption levels for each rate class and service region. The Residential sector defined in this CPR includes only customers from Rate class 1. Large multi-unit residential buildings from classes 2, 3, and 23 are reported in the Commercial sector report.

- Exhibit 47 shows a Lower Mainland Residential sector load factor rate of 0.272.

- Finally, peak day load impacts were calculated by dividing the average daily consumption by the appropriate sector and service region load factors.

Exhibit 47 Peak Day Load Factors, by Sector and Service Region

CPR Sector	Sales Weighted Average/Peak Load Factor, by Sector & Service Region*				
	Lower Mainland	Southern Interior	Northern Interior	Vancouver Island	Whistler
Residential	0.272	0.266	0.266	0.279	0.269
Commercial	0.358	0.298	0.288	0.380	
Manufacturing	0.589	0.812	0.862	0.384	

*Above sector load factors are sales weighted values based on the rate class load factors shown below.

Rate Class (FEI, FEVI, FEW)	Average/Peak Load Factor, by Rate Class & Service Region#			
	Lower Mainland (FEI)	Inland (FEI)	Vancouver Island (FEVI)	Whistler (FEW)
Rate 1, RGS, SGS1/2 RES	0.272	0.266	0.279	0.269
Rate 2, SCS1, SGS1/2 COMM	0.279	0.256	0.308	0.402
Rate 3, SCS2, LGS1	0.357	0.329	0.386	0.346
Rate 5, LCS1, LGS2	0.463	0.485	0.384	0.385
Rate 6, LCS2, LGS3	1.125	0.719	0.416	0.363
Rate 25, AGS, N/A	0.507	0.517	0.383	

#Source: FortisBC

Exhibit 48 and Exhibit 49 summarizes the estimated peak day load impacts for each of the Achievable Potential scenarios. The results for the *aggressive* Achievable Potential are presented in Exhibit 48 and the results for the *most likely* Achievable Potential are presented in Exhibit 49. The values in these exhibits are estimates of the natural gas reduction on the system peak day.

Exhibit 48 Peak Day Capacity Impacts – Aggressive Achievable Potential, by Scenario, Service Region and Milestone Year (GJ)

Year	Lower Mainland	Northern Interior	Southern Interior	Vancouver Island	Whistler	Grand Total
2015	11,686	2,683	1,676	530	39	16,614
2020	25,557	5,711	3,705	1,181	60	36,214
2025	37,702	8,034	5,410	1,997	54	53,196
2030	41,351	9,632	5,890	2,205	47	59,126
Savings 2030 Relative to Total 2030 Savings	70%	16%	10%	4%	0.1%	100%

Exhibit 49 Peak Day Capacity Impacts – Most Likely Achievable Potential, by Scenario, Service Region and Milestone Year (GJ)

Year	Lower Mainland	Northern Interior	Southern Interior	Vancouver Island	Whistler	Grand Total
2015	5,294	1,224	747	256	17	7,539
2020	11,830	2,670	1,695	575	29	16,800
2025	17,913	3,840	2,543	995	28	25,319
2030	23,904	5,182	3,398	1,215	25	33,724
Savings 2030 Relative to Total 2030 Savings	71%	15%	10%	4%	0.1%	100%

8.4.4 *Greenhouse Gas Emission Impact – Energy-efficiency Scenarios*

The natural gas savings associated with each of the Achievable Potential scenarios would also result in a reduction of greenhouse gas (GHG) emissions.[23] Exhibit 50 and Exhibit 51 provide the estimated GHG reduction impact of each of the two Achievable Potential scenarios.

Exhibit 50 Estimated GHG Emission Reductions – Aggressive Achievable Potential, By Scenario and Milestone Year (tonnes CO_2e/yr.)

Year	Lower Mainland	Northern Interior	Southern Interior	Vancouver Island	Whistler	Grand Total
2015	58,723	13,220	8,255	2,738	192	83,129
2020	128,426	28,136	18,252	6,096	301	181,211
2025	189,455	39,580	26,653	10,307	268	266,263
2030	207,792	47,455	29,016	11,384	236	295,883
Savings 2030 Relative to Total 2030 Savings	70%	16%	10%	4%	0.1%	100%

Exhibit 51 Estimated GHG Emission Reductions – Most Likely Achievable Potential, By Scenario and Milestone Year (tonnes CO_2e/yr.)

Year	Lower Mainland	Northern Interior	Southern Interior	Vancouver Island	Whistler	Grand Total
2015	26,603	6,032	3,681	1,322	85	37,724
2020	59,447	13,156	8,352	2,966	146	84,067
2025	90,014	18,917	12,530	5,139	138	126,737
2030	120,118	25,530	16,741	6,270	126	168,785
Savings 2030 Relative to Total 2030 Savings	71%	15%	10%	4%	0.1%	100%

8.4.5 *Interpretation of Results*

Highlights of the potential natural gas savings presented in the preceding exhibits are summarized below.

[23] GHG impacts are estimated based on an emissions factor of 50.7 kg of CO_2e per GJ of natural gas. This is the value currently employed by Natural Resources Canada.

Savings by Service Region

The Lower Mainland service region represents approximately 70% of the identified savings in either of the two Achievable Potential scenarios. This is consistent with the large number of customers in this service region. The Northern Interior service region represents approximately 15% of the identified savings, followed by Southern Interior at 10% and then Vancouver Island at 4%.

In the Northern Interior, potential savings are 6%-11% of the Reference Case consumption in 2030, depending on whether the *most likely* or *aggressive* levels of potential are achieved. This is the highest percentage of any of the regions. In the Lower Mainland, potential savings are 5%-8% of the Reference Case consumption in 2030. In the Southern Interior, potential savings are 4%-7% of Reference Case consumption in 2030. In the Vancouver Island service region, they are 2%-4%, and in the Whistler service region, they are 1%-2% of Reference Case consumption in 2030. The variation from region to region relates closely to the age and efficiency of existing gas furnaces in the building stock.

Savings by Milestone Year

In contrast to the Economic Potential scenario, savings in both Achievable Potential scenarios are achieved more steadily throughout the study period. Based on the adoption patterns estimated by the workshop participants, under the *most likely* scenario 22% of the 2030 savings would be achieved by 2015, 50% by 2020, and 75% by 2025. In the *aggressive* scenario, 28% would be achieved by 2015, 61% by 2020, and 90% by 2025. Overall, the *most likely* scenario represents an even rate of adoption throughout the 20 years, whereas the *aggressive* scenario results in more of the full-cost measures being adopted early.

Savings by Dwelling Type

Single-family dwellings account for approximately 94% of the potential savings, which reflects their larger market share and their generally higher level of energy intensity per dwelling.

Savings by End Use

Space heating accounts for nearly 80% of the total energy savings in the two Achievable Potential scenarios. The largest contributor to these savings by far is the early retirement of gas furnaces, which accounts for approximately half of the total Achievable Potential savings. The remaining space heating savings are from programmable thermostats, homeowner air sealing, and improved insulation in basements, attics and walls.

Fireplaces account for approximately 12%-13% of total energy savings in the two Achievable Potential scenarios. These savings are all from upgrading to more efficient fireplaces at the natural rate of replacement or new purchase.

Swimming pool and spa heaters account for approximately 6% of the total savings in the two Achievable Potential scenarios. These savings are from solar pool heaters.

DHW accounts for approximately 3% of the total energy savings in the two Achievable Potential scenarios. These savings come from several measures, including ultra low-flow showerheads, efficiency clothes washers, faucet aerators, hot water pipe insulation, and hot water tank insulation.

Clothes dryers account for less than 1% of the total savings in the two Achievable Potential scenarios. These savings result from the faster spin cycles of efficient clothes washers.

Peak Day Capacity Impacts

The natural gas savings contained in the two Achievable Potential scenarios would result in a total peak day load reduction of approximately 34,000 GJ to 59,000 GJ by 2030, depending on the scenario.

Greenhouse Gas Emission Impacts

By 2030 the GHG reductions are estimated to be in the range of 169,000 to 296,000 tonnes/year, depending on scenario.

8.5 Results – Customer Behaviour

A selection of the unbundled savings potential from customer behaviours changes were also addressed as part of the one day residential sector workshop that was held on 25 January, 2011. The approach to the assessment of the achievable potential savings from customer behaviours was the same as for the energy efficiency technologies previously discussed.

Exhibit 52 presents a summary of the results for both the aggressive and most likely achievable potential scenarios.

It should be noted that there is significant potential overlap with the reported savings from energy efficiency technologies. Consequently, the behaviour savings shown in Exhibit 52 have not been added to those for the energy efficiency technologies, nor has any further analysis been undertaken at this time.

Exhibit 52 Achievable Potential from Customer Behaviour Changes, Aggressive and Most Likely Achievable Natural Gas Savings, by End Use and Milestone Year (1000 GJ/yr.)

	Behaviour Measure	Scenario	Participation Factor				Curve	Energy Impact (1000 GJ/yr.)			
			2015	2020	2025	2030		2015	2020	2025	2030
Space Heating	Temperature Setback Over Night	Aggressive**	3%	13%	28%	50%	C	12	47	104	184
		Most Likely**	2%	6%	14%	25%	C	6	23	52	92
	Temperature Setback when away during day	Aggressive	3%	13%	28%	50%	C	13	51	115	203
		Most Likely	2%	6%	14%	25%	C	6	26	57	101
	Heat Occupied Parts of House Only	Aggressive	13%	25%	38%	50%	A	94	188	280	371
		Most Likely	6%	13%	19%	25%	A	47	94	140	185
	Maintain Weather stripping	Aggressive**	4%	15%	34%	60%	C	28	114	255	450
		Most Likely**	3%	10%	23%	40%	C	19	76	170	300
	Install Storm Windows	Aggressive	13%	25%	38%	50%	A	65	130	194	256
		Most Likely	6%	13%	19%	25%	A	32	65	97	128
	Close Blinds & shades during space heat	Aggressive	3%	10%	23%	40%	C	17	69	155	274
		Most Likely	1%	5%	11%	20%	C	9	35	78	137
	Subtotal	Aggressive						229	598	1,103	1,738
		Most Likely						119	318	594	944
DHW	Turn off Water Heater when on vacation	Aggressive	15%	30%	45%	60%	A	6	12	17	21
		Most Likely	8%	15%	23%	30%	A	3	6	8	10
	Reduce Temperature of Tank	Aggressive	13%	25%	38%	50%	A	7	14	19	23
		Most Likely	6%	13%	19%	25%	A	4	7	9	12
	Minimize Hot and Warm Water Wash	Aggressive**	4%	18%	39%	70%	C	42	163	332	550
		Most Likely**	3%	10%	23%	40%	C	24	93	190	314
	Reduce Shower Length	Aggressive	8%	15%	23%	30%	A	98	187	255	317
		Most Likely	4%	8%	11%	15%	A	49	94	128	158
	Subtotal	Aggressive						154	376	623	911
		Most Likely						80	200	335	495
Residential	Total	Most Likely						383	975	1,727	2,649
		Aggressive						199	518	930	1,439

*** Participation factors from Achievable Workshop*

9 References

The sources listed below include references used in preparation of this report and additional resources likely to be helpful for research on energy consumption patterns and efficient technologies. Additional references on specific technologies may be found in the TRC Analysis Workbooks, supplied as an accompanying deliverable with this report.

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10 Glossary

achievable potential
The Achievable Potential is the proportion of the natural gas savings identified in the Economic Potential Forecast that could realistically be achieved within the study period. Achievable Potential recognizes that it is difficult to induce customers to purchase and install all of the efficiency technologies that meet the criteria defined by the Economic Potential Forecast.

avoided cost
The unit cost of acquiring the next resource to meet demand, which is used as a measure for evaluating individual demand-side and supply-side options. In the context of this study "avoided cost" is the capital expenditure offset by FortisBC's DSM activities (i.e., the cost of having to buy natural gas on the open market, contract for long-term supply, and the cost of associated transmission and storage.

base year
The Base Year is the year to which all potentials will be compared. It provides a detailed description of "where" and "how" natural gas is currently used in each sector. For this study, it is the calendar year 2010. The modelled base year energy use is calibrated against FortisBC's actual sales for 2009.

benefit/cost ratio
The measure benefit/cost ratio indicates the relative attractiveness of the measures. A measure that has a benefit/cost ratio in excess of 1.0 has benefits which outweigh its costs. Similarly, a measure with a benefit/cost ratio that is well in excess of one (e.g., 3.0) means that it is very attractive. A measure with a benefit/cost ratio of less than 1.0 has costs which outweigh its benefits.

building envelope
The material separation between the interior and the exterior environments of a building. The building envelope serves as the outer shell to protect the indoor environment as well as to facilitate its climate control.

british thermal unit or BTU
The standard measure of heat energy. It takes one Btu to raise the temperature of one pound of water by one degree Fahrenheit at sea level

co-generation
The simultaneous production of electric or mechanical energy and useful heat energy from a single fuel source.

combustion efficiency
The ratio of energy released during combustion to the potential chemical energy available in the fuel.

demand-side management (DSM)
Actions taken by a utility or other agency which are expected to influence the amount or timing of a customers energy consumption.

discount rate
The interest rate used in calculating the present value of expected yearly benefits and costs.

economic efficiency
Allocation of human and natural resources in a way that results in the greatest net economic benefit, regardless of how benefits and costs are distributed within society.

economic potential forecast
The economic potential forecast is an estimate of the level of natural gas consumption that would occur if all equipment and building envelopes were upgraded to the level that is cost effective from society's perspective. All of the energy-efficiency technologies and measures that have a positive measure TRC are incorporated into the economic potential forecast. These technologies and measures are applied at either natural stock turnover rates or at designated years for immediate application.

energy audit
An on-site inspection and cataloguing of energy using equipment/buildings, energy consumption and the related end-uses. The purpose is to provide information to the customer and the utility. Audits are useful for load research, for DSM program design and for identification of specific energy savings measures.

energy conservation
Activities by energy users that result in a reduction of the energy used to provide services. Energy conservation can include a wide variety of behavioural or operational changes that result in energy savings..

energy efficiency
Using less energy to perform the same function.

energy intensity
The ratio of energy consumed per application or end use. For example, cubic metres per square metre of heated office space per day, or cubic metres per tonne of aluminum produced. All else being equal, energy intensity increases as energy efficiency decreases.

emerging technologies
New energy-conserving technologies that are not yet market-ready, but may be market-ready over next 5 to 10 years. This category includes technologies that could be accelerated into the market during that period through targeted financial or technical support.

end use
The final application or final use to which energy is applied. End use is often used interchangeably with energy service.

energy savings
The reduction in use of energy from the pre retrofit baseline to the post retrofit energy use that result from efficient technologies or activities. In this document, the term "energy" refers specifically to energy derived from natural gas unless otherwise noted.

energy service
An amenity or service supplied jointly by energy and other components/equipment such as buildings and heating equipment. Examples of energy services include residential space heating, commercial cooking, aluminum smelting and public transit. The same energy service can frequently be supplied with different mixes of equipment and energy.

energy use index (EUI)
End use energy consumption divided by a specific parameter of production (e.g., m^3/unit)
environmental credit/environmental penalty
An increment or decrement to the cost of a resource or set of resources, to reflect the overall level of its/their environmental impact, relative to another resource or set of resources.

financial incentive
Certain financial features in the utility's DSM programs designed to motivate customer participation. They may include features designed to reduce a customer's net cash outlay, pay-back period or cost of finance to participate.

fuel share
The proportion of requirements for a specific service that is met using a certain fuel. In the Commercial sector, fuel shares are normalized on a floor area basis. For example, a natural gas fuel share of 90% for space heating in the Large Office sub sector implies that 90% of the sub sector floor space is heated using natural gas.

free rider
A program participant who would have implemented the program measure or practice in the absence of the program.

interactive effects
In the context of natural gas use, interactive effects refer to the increase in gas consumed by heating equipment required to offset a decrease in "waste" heat generated by more efficient electrical fixtures or appliances after retrofit or replacement.

kilowatt (kW)
One thousand watts; the most common unit of measurement of electric power. (The amount of energy transferred at a rate of one kilowatt for one hour is equal to one kilowatt hour.)

kilowatt hour (kWh)
The most common unit of measurement of electric energy. One kilowatt hour represents the power of one thousand watts for a period of one hour.

load forecast
An estimate of expected natural gas requirements that have to be met by the utility in future years.

load research
Research to disaggregate and analyze patterns of natural gas consumption by various subsectors and end-uses. Load Research supports the development of the load forecast and the design of demand-side management programs.

market transformation
A reduction in market barriers resulting from a market intervention, as evident by a set of market effects that lasts after the intervention has been withdrawn, reduced or changed.

measure total resource cost (TRC)
The Measure TRC is the net present value of energy savings that result from an investment in a energy efficiency measure. The Measure TRC is equal to its full or incremental capital cost (depending on application) plus any change (positive or negative) in the combined annual energy and operating & maintenance costs. This calculation includes among others, the following inputs: the avoided natural gas, electricity and water; the life of the measure; and the selected discount rate.

natural conservation
The future change in energy intensity or base usage that is expected to occur in the absence of utility DSM programs. Natural change represents the effects of energy related decisions that would have been made in the absence of the utility programs by both program participants and non-participants

rate
Generically refers to a utility's rate structure.

rate structure
The formulae used by a regulated gas utility to calculate charges for the use of natural gas..

rebates
A type of incentive provided to encourage the adoption of energy efficeing practices, typically paid after the measure has been installed. There are typically two types of rebates: a Prescriptive Rebate, which is a prescribed financial incentive/unit for a prescribed list of products and a customized rebate in which the financial incentive is determined using an analysis of the customer equipment and an agreement on the specific products to be installed.

reference case forecast
An estimate of the expected level of natural gas consumption that would occur over the study period in the absence of any new utility DSM market interventions after 2010. It is the baseline against which the scenarios of energy savings are calculated. The Reference Case forecast incorporates an estimation of "natural conservation," namely, changes in end-use efficiency over the study period that are projected to occur in the absence of new market interventions by the utility.

retrofit
Energy efficiency activities undertaken in existing residential or non residential buildings where existing inefficient equipment is replaced by efficient equipment.

saturation
The portion of floor area that receives a specific energy service. For example, a saturation of 86% for space cooling in the Large Office sub sector means that 86% of the sub sector floor space is cooled (regardless of fuel used to provide that cooling).

seasonal efficiency
The ratio of delivered useful energy relative to the input potential fuel energy determined over a full heating season (or year).

sector
A group of customers having a common type of economic activity.

service area
The portion of the Province of British Columbia that receives service from FortisBC Gas.

service region
For the purposes of this study, the total FortisBC Gas service area is divided into two service regions. They are the Southern Region and the Eastern Region.

simple payback
The simple payback is generated to show the customer's financial perspective. Simple payback is a measure of the length of time required for the cumulative savings from a project to recover its initial investment cost, without taking into account the time value of money

sub sectors
A classification of customers within a sector by common features. Residential subsectors are by type of home (SFD, duplex, apartment, etc.). Commercial subsectors are generally by type of commercial service (office, retail, warehouse, etc.). Industrial subsectors are by product type (pulp and paper, solid wood products, chemicals, etc.).

supply curves
A curve illustrating the amount of energy (e.g., m^3) or societal benefit available at an appropriate screened price in ascending order of cost.

Total Resource Cost (TRC) Test
A test that compares the total costs of energy efficiency investments, including natural gas conservation programs, to the social cost of natural gas. Un-priced environmental and social costs may be accounted for by changing the cost of either the investment under consideration or the total cost of natural gas in such a way that relative un-priced impacts are reflected. It is used in designing and evaluating programs that are developed from the Energy Efficiency Potential study's results.

utility cost
The total financial cost incurred by the utility to acquire energy resources. For DSM, the costs include all utility program costs, including incentive costs.

watt
The basic unit of measurement of power, at a point in time as capacity or demand.

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CONSERVATION POTENTIAL REVIEW-2010 FortisBC

Residential Sector

Energy-efficiency, Alternative Energy & Customer Behaviour Opportunities

APPENDICES

Submitted to
FortisBC

Submitted by
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Appendix A Background - Section 3: Base Year Natural Gas Use

Introduction

This appendix provides background supporting information for the Base Year calibration presented in Section 3. The discussion is organized into the following subsections:

- Estimation of space heating loads
- Estimation of appliance energy consumption
- Estimation of appliance saturation
- Estimation of fuel share by end use
- Calibration of most recent sales data (for 2009) and adjustment to the study Base Year of 2010
- Model results – Base Year energy use.

Estimation of Net Space Heating Loads

The net space heating loads[24] as shown in Exhibit 5 were developed based on two data sources:

- FortisBC sales data that shows average consumption per residential customer.
- HOT2000 simulations of archetypal buildings that were originally developed for the 2007 BC Hydro study. These building archetypes have been updated using data from the EnerGuide for Houses and ecoENERGY databases, as analyzed in *Residential Existing House Statistics*.[25]

A brief discussion of some of the most important variables affecting the net space heating loads in British Columbia's residential stock is presented below.[26]

Envelope Area and Exposure

Attachment type is the main influence on building envelope area and exposure of buildings. Moving from greatest exposure to least, dwelling types include mobile homes, single-family, duplex, townhouse or row, and low- and high-rise apartments. Duplexes are built in a similar fashion to single-family homes but, from an exposure perspective, are more similar to row houses. Townhouses, which also share one or two walls, are, on average, smaller than single-family detached dwellings. Apartments are analyzed in the Commercial sector report.

Climate

British Columbia has a far greater diversity of climatic types than any other region in Canada, which creates a unique situation when it comes to defining building types. The simplest division on a climatic basis is between the coastal areas and the interior. Approximately 75% of the residential stock in British Columbia is located in the coastal areas, including Vancouver Island and the Lower Mainland. The remainder is spread out over the interior where the climate is similar to that of northern Canada and the Prairies. In general, this climatic divide results in major variations in the size, structure and thermal performance of buildings. For data analysis purposes, however, it was necessary to work with the regions that BC Hydro and FortisBC had already established for customer accounts. In general, the coastal climate corresponds to British Columbia's Lower Mainland and Vancouver Island regions. The Southern Interior region,

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[24] Net space heating load is the space heating load of a building that must be met by the space heating system. This is equal to the total heat loss through the building envelope minus solar and internal gains.
[25] Ken Cooper, *Residential Existing House Statistics*, prepared for FortisBC, 2010.
[26] For reader convenience, the following sub sections are repeated from the earlier BC Hydro study, with minor modifications as applicable.

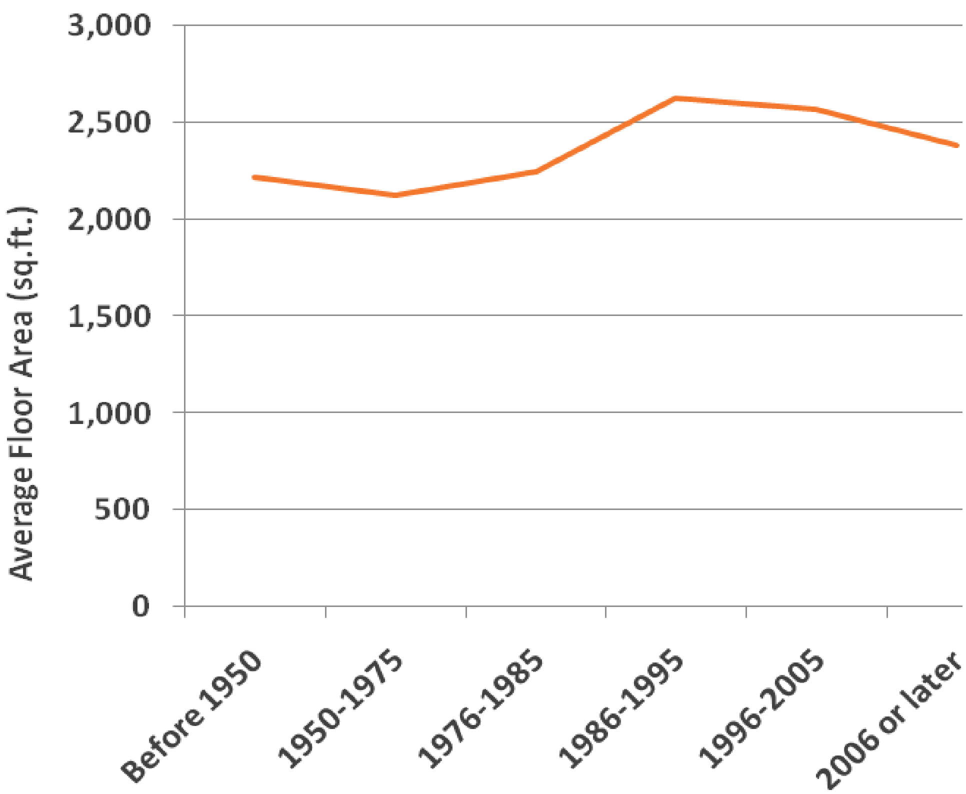
including the southern part of FortisBC's Inland Region as well as Columbia, has a colder interior climate. The Northern Interior region, including the northern part of FortisBC's Inland Region and Fort Nelson, is considerably colder yet. Whistler has a climate intermediate between the two interior climates. For modelling purposes, weather data from Vancouver, Victoria and Whistler were used to create thermal simulations of the Lower Mainland, Vancouver Island and Whistler regions, respectively. Summerland was used for the Southern Interior and Prince George was used for the Northern Interior.

Floor Area and Shape

Exhibit A 1 presents the average floor area by construction date for single detached houses, based on data from the 2008 REUS. As can be seen, there has been a general increase in floor area over time. The biggest changes in housing size occurred between 1975 and 1995 when changing demographics and growing affluence resulted in larger floor areas for new houses. Since that time, average house size has gradually decreased. Exhibit A 2 presents the variation in average floor area for both single detached houses and multi-family (attached) houses by region. As the exhibit shows, houses in the Lower Mainland are generally larger than those in the Vancouver Island and two Interior regions. Houses in Whistler are larger still.

The shapes of houses have also changed over the years, as they have in other Canadian provinces. Pre-1970 houses typically have half-storeys and simple floor plans. Post-1970 houses are most likely to include split-levels, ranches and two-storey houses, with more complex floor plans. As a result, newer houses generally have more wall area relative to their floor area. In other words, average wall area in new homes has grown faster than floor area. Finally, due to the improved performance of newer windows, the area of glazing has increased by about 15%.

Exhibit A 1 Average Floor Areas for Detached Dwellings by Construction Date (sq. ft.)



Source: 2008 Residential End Use Survey.

Exhibit A 2 Average Floor Areas for Detached and Attached Dwellings by Region (sq. ft.)

Dwelling Type	Lower Mainland	Interior	Vancouver Island	Whistler	Fort Nelson
Single Detached House	2,338	2,169	2,084	2,520	1,839
Multi-family (attached) Dwelling	1,699	1,596	1,553	1,583	**

Source: 2008 Residential End Use Survey
** Sample size too small to report estimate.

Basement Style

Basement style also affects space heating consumption. For example, full basements (e.g., ceiling height of 7 to 8 ft.) result in greater exterior wall area and room volume that require more heating than, say, a crawlspace, where ceiling heights are typically four feet or less.

Data on basement detachment styles was collected in the 2008 REUS and the results are shown in Exhibit A 3.

Exhibit A 3 Basement Style by Region

Dwelling Type	Lower Mainland	Interior	Vancouver Island	Whistler	Fort Nelson
No basement	24.9%	11.0%	22.2%	31.3%	31.1%
Partial	11.5%	13.3%	13.5%	19.7%	8.1%
Full	48.2%	65.8%	37.9%	14.6%	54.1%
Crawlspace	15.4%	9.8%	26.4%	34.4%	6.7%
Total	100.0%	99.9%	100.0%	100.0%	100.0%
Basement or crawlspace	75.1%	88.9%	77.8%	68.7%	68.9%

Source: 2008 Residential End Use Survey

Space Heating Efficiency

Natural gas furnaces are generally categorized into high-, mid- and standard efficiency levels. Data collected in the 2008 REUS were analyzed and presented in Table 4.1 of the 2010 Long Term Resource Plan. Exhibit A 4 reproduces the data in that table and also shows an estimate of the average efficiency of furnaces in each region, based on the following assumptions:

- Standard efficiency furnaces average 70% efficiency
- Mid-efficiency furnaces average 81.5% efficiency
- High-efficiency furnaces average 92% efficiency.

The estimated average furnace efficiency is lowest in the Lower Mainland and highest in Whistler.

Exhibit A 4 Existing Natural Gas Furnace Distribution, by Efficiency Level

Gas Furnace Efficiency	Lower Mainland	Interior	Vancouver Island	Whistler	Fort Nelson
Standard Efficiency (less than 78% AFUE; assumed mean 70%)	52.1%	38.0%	19.0%	20.7%	29.2%
Mid-efficiency (78% to 85% AFUE; assumed mean 81.5%)	34.0%	44.2%	56.5%	42.8%	49.5%
High-efficiency (80% AFUE or higher; assumed mean 92%)	13.9%	17.7%	24.5%	36.5%	21.2%
Total	100.0%	99.9%	100.0%	100.0%	99.9%
Estimated overall mean AFUE	77.0%	78.9%	81.9%	83.0%	80.3%

Source: 2008 Residential End Use Survey and 2010 Long Term Resource Plan

Supplemental Heating

The use of supplemental heating in residential dwellings is a dynamic process shaped by a number of factors. During the 1970s and 1980s, a small percentage of houses in British Columbia were converted to electric heating from other fuels. This occurred primarily on Vancouver Island, either as part of the Electric Plus program, or as a result of the federal government's Canadian Oil Substitution Program (COSP). These conversions had the effect of increasing the numbers of older housing stock with electric heat. A fraction of 1940s and 1950s housing with uninsulated walls and foundations was converted to electric heating.

During the mid-1980s, low-temperature radiant electric heating once again became popular. In a number of fast-growing subdivisions in the Lower Mainland area, electric heating was combined with forced-air gas furnaces. This hybrid system was popular because of easy installation and low capital cost. A gas-fueled forced-air system was installed in the crawlspace and main floor portions of the house, and electric baseboards were installed upstairs. This avoided the requirement for ducting up to the second storey, and the trades promoted it on the basis that "heat rises," and therefore the electric heating was simply a backup for the coldest weather.

More recently, increases in the cost of natural gas and propane fuels have resulted in significant increases in the use of portable electric resistance heaters during periods of higher priced fossil fuels.[27]

In addition to fuel conversions and substitutions, there are a large number of home renovations and additions that have involved the installation of electric space heating in previously non-electrically heated houses. Electric baseboards are a convenient, low first-cost installation for a new room in an existing house. Presumably this phenomenon has been occurring since the mid-1960s and growing in proportion to the rapidly increasing rates of renovation and addition building in the 1970s and 1980s.

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[27] Personal communications with major British Columbia home improvement retail outlets.

The results of the 2008 REUS show the incidence of supplemental heating equipment for each region, as well as the fuels used, as illustrated in Exhibit A 5. Unfortunately, these data only show the incidence of each type of heating equipment; they do not tell how much space heat is actually provided by the equipment. This makes the calculation of actual electric heat contribution difficult. (The amount of space heat provided by supplemental heating systems is addressed below under *Natural Gas Fuel Shares*.)

Exhibit A 5 Incidence of Supplementary Space Heating and Fuels Used, by Region, (%)

Dwelling Type	Lower Mainland	Interior	Vancouver Island	Whistler	Fort Nelson
Use of Supplementary Heating	54.3%	55.3%	64.8%	80.8%	43.5%
Fuels Used *	**Lower Mainland**	**Interior**	**Vancouver Island**	**Whistler**	**Fort Nelson**
Electricity	75.2%	68.0%	54.4%	59.1%	68.2%
Natural gas	8.9%	9.2%	34.8%	6.8%	4.5%
Piped propane	0.0%	0.0%	0.1%	20.5%	0.0%
Bottled propane	0.6%	0.0%	0.0%	0.0%	0.0%
Oil	0.6%	0.8%	0.4%	0.0%	0.0%
Wood	14.0%	28.8%	14.8%	31.8%	22.7%
Other	0.6%	1.2%	0.8%	0.0%	0.0%

Source: 2008 Residential End Use Survey
* Multiple responses are allowed.

Estimation of Net Space Heating Loads

Exhibit 6 in Section 3.2.2 provides the estimated UEC values for the Lower Mainland region. The values shown in Exhibit 6 apply to the current stock mix in the Lower Mainland. UECs for the other service regions are shown in Exhibit A 6, Exhibit A 7, Exhibit A 8, and Exhibit A 9 below.

Exhibit A 6 Annual Appliance Natural Gas Use (UEC) for the Vancouver Island Region in Base Year (MJ/yr.)

Dwelling Types	Domestic hot water (DHW)	Fireplace	Cooking	Clothes dryer	Pool & spa heaters	Other gas uses
SFD/Duplex, gas heat, pre-1976	15,214	16,836	4,510	3,636	27,693	951
SFD/Duplex, gas heat, 1976 or newer	15,214	16,836	4,510	3,636	27,693	951
SFD/Duplex, non-gas heat, pre-1976	15,214	16,836	4,510	3,636	27,693	951
SFD/Duplex, non-gas heat, 1976 or newer	15,214	16,836	4,510	3,636	27,693	951
Attached/Row, gas heat, pre-1976	13,474	10,253	4,002	3,244	27,693	847
Attached/Row, gas heat, 1976 or newer	13,474	10,253	4,002	3,244	27,693	847
Attached/Row, non-gas heat, pre-1976	13,474	10,253	4,002	3,244	27,693	847
Attached/Row, non-gas heat, 1976 or newer	13,474	10,253	4,002	3,244	27,693	847
Mobile/other, gas heat	13,179	10,253	3,902	3,644	27,693	829
Mobile/other, non-gas heat	13,179	10,253	3,902	3,644	27,693	829

Exhibit A 7 Annual Appliance Natural Gas Use (UEC) for the Southern Interior Region in Base Year (MJ/yr.)

Dwelling Types	Domestic hot water (DHW)	Fireplace	Cooking	Clothes dryer	Pool & spa heaters	Other gas uses
SFD/Duplex, gas heat, pre-1976	14,934	17,121	4,599	3,701	27,693	689
SFD/Duplex, gas heat, 1976 or newer	14,934	17,121	4,599	3,701	27,693	689
SFD/Duplex, non-gas heat, pre-1976	14,934	17,121	4,599	3,701	27,693	689
SFD/Duplex, non-gas heat, 1976 or newer	14,934	17,121	4,599	3,701	27,693	689
Attached/Row, gas heat, pre-1976	12,609	11,300	3,889	3,303	27,693	613
Attached/Row, gas heat, 1976 or newer	12,609	11,300	3,889	3,303	27,693	613
Attached/Row, non-gas heat, pre-1976	12,609	11,300	3,889	3,303	27,693	613
Attached/Row, non-gas heat, 1976 or newer	12,609	11,300	3,889	3,303	27,693	613
Mobile/other, gas heat	13,001	11,300	4,016	3,482	27,693	601
Mobile/other, non-gas heat	13,001	11,300	4,016	3,482	27,693	601

Exhibit A 8 Annual Appliance Natural Gas Use (UEC) for the Northern Interior Region in Base Year (MJ/yr.)

Dwelling Types	Domestic hot water (DHW)	Fireplace	Cooking	Clothes dryer	Pool & spa heaters	Other gas uses
SFD/Duplex, gas heat, pre-1976	17,189	14,333	5,111	4,111	27,693	802
SFD/Duplex, gas heat, 1976 or newer	17,189	14,333	5,111	4,111	27,693	802
SFD/Duplex, non-gas heat, pre-1976	17,189	14,333	5,111	4,111	27,693	802
SFD/Duplex, non-gas heat, 1976 or newer	17,189	14,333	5,111	4,111	27,693	802
Attached/Row, gas heat, pre-1976	14,514	9,460	4,322	3,669	27,693	714
Attached/Row, gas heat, 1976 or newer	14,514	9,460	4,322	3,669	27,693	714
Attached/Row, non-gas heat, pre-1976	14,514	9,460	4,322	3,669	27,693	714
Attached/Row, non-gas heat, 1976 or newer	14,514	9,460	4,322	3,669	27,693	714
Mobile/other, gas heat	14,965	9,460	4,462	3,869	27,693	700
Mobile/other, non-gas heat	14,965	9,460	4,462	3,869	27,693	700

Exhibit A 9 Annual Appliance Natural Gas Use (UEC) for the Whistler Region in Base Year (MJ/yr.)

Dwelling Types	Domestic hot water (DHW)	Fireplace	Cooking	Clothes dryer	Pool & spa heaters	Other gas uses
SFD/Duplex, gas heat, pre-1976	21,578	24,593	5,989	4,763	27,693	2,474
SFD/Duplex, gas heat, 1976 or newer	21,578	24,593	5,989	4,763	27,693	2,474
SFD/Duplex, non-gas heat, pre-1976	21,578	24,593	5,989	4,763	27,693	2,474
SFD/Duplex, non-gas heat, 1976 or newer	21,578	24,593	5,989	4,763	27,693	2,474
Attached/Row, gas heat, pre-1976	18,219	16,232	5,065	4,251	27,693	2,203
Attached/Row, gas heat, 1976 or newer	18,219	16,232	5,065	4,251	27,693	2,203
Attached/Row, non-gas heat, pre-1976	18,219	16,232	5,065	4,251	27,693	2,203
Attached/Row, non-gas heat, 1976 or newer	18,219	16,232	5,065	4,251	27,693	2,203
Mobile/other, gas heat	18,785	16,232	5,230	4,482	27,693	2,158
Mobile/other, non-gas heat	18,785	16,232	5,230	4,482	27,693	2,158

A brief discussion of some of the most important variables affecting the UEC values in British Columbia's residential stock is presented below.

Occupancy

Average occupancy rates by region were obtained from the data presented in the 2008 REUS, and are shown in Exhibit A 10. Average occupancy rates for single detached homes and multi-family (attached) dwellings are shown in Exhibit A 11. In this study, they are used, as applicable, to estimate energy use for occupant-sensitive end uses, such as domestic hot water (DHW), cooking and laundry.

Exhibit A 10 Occupancy Rates by Region

	Lower Mainland	Interior	Vancouver Island	Whistler	Fort Nelson
Mean Household Occupancy	3.01	2.43	2.39	3.04	2.70

Source: 2008 Residential End Use Survey

Exhibit A 11 Occupancy Rates by Dwelling Type

	Single Detached Houses	Multi-Family (Attached) Dwellings
Mean Household Occupancy	2.82	2.38

Source: 2008 Residential End Use Survey

Domestic Hot Water

UEC estimates for DHW are based primarily on the findings of the FortisBC 2008 REUS and natural gas sales data provided by FortisBC, adjusted for variations in occupancy rates as shown above. Exhibit A 12 shows the estimated distribution of DHW load by sub end use.

Exhibit A 12 Distribution of DHW Energy Use by End Use in Existing Stock

DHW Sub End Uses	Gas Consumption per Sub End Use (MJ)	Gas Consumption per Sub End Use (%)
Showers	5,001	24%
Clothes washer	4,601	22%
Faucets	3,572	17%
Dishwasher	3,242	15%
Pipe losses	1,429	7%
Tank (standby) losses	1,429	7%
Leaks	1,072	5%
Baths	714	3%
Total	21,061	100%

Note: Any differences in totals are due to rounding.

The DHW values shown in Exhibit A 12 are based on a combination of sources including available data from other jurisdictions, Natural Resources Canada studies (NRCan, 2005) and the results of conditional demand analysis and customer survey work presented in the 2008 REUS.

Cooking

UEC estimates for the existing stock of this group of food preparation appliances were initially developed using the conditional demand analysis from the 2008 REUS, and these values were compared against values for electric cooking appliances obtained from *Energy Consumption of Major Household Appliances Shipped in Canada* (NRCan, 2008). Comparing the two sets of values showed that gas consumption values were consistent with range efficiencies below 40%. The gas consumption values were adjusted downward to be consistent with range efficiencies of approximately 50%, which is consistent with previous Marbek studies for FortisBC and other Canadian gas utilities. Energy consumption was adjusted for occupancy rates.

Dryer

UEC estimates for the existing stock of clothes dryers were initially developed using the conditional demand analysis from the 2008 REUS, and these values were compared against values for electric dryers obtained from *Energy Consumption of Major Household Appliances Shipped in Canada* (NRCan, 2008). Comparing the two sets of values showed gas consumption values were consistent with range efficiencies over 100%. The gas consumption values were adjusted downward to be consistent with dryer efficiencies of approximately 85%, which is consistent with previous Marbek studies for FortisBC and other Canadian gas utilities. Energy consumption was adjusted for occupancy rates.

Pool or Spa Heater

UEC estimates for the existing stock of pool and spa heaters were developed using the conditional demand analysis from the 2008 REUS. Previous Marbek work concluded that gas-fired pool heaters use approximately the same amount of energy as a typical primary gas space heating appliance in a home. The figures in the FortisBC conditional demand analysis show that in British Columbia, the consumption of average pool heaters is somewhat less in relation to furnace consumption, as compared with other jurisdictions. This additional information was used to adjust the pool heater average consumption for the FortisBC service area. The average figure has not been adjusted for climate differences between regions. In colder regions, heating requirements per day may be higher, but the swimming season is also shorter.

Fireplaces

UEC estimates for the existing stock of gas fireplaces were developed using the conditional demand analysis from the 2008 REUS. The average gas fireplace in other jurisdictions uses approximately 20% as much energy as a primary gas heating appliance.[28] Gas fireplace consumption in the FortisBC service area would be expected to be higher relative to the consumption of the furnace because furnace consumption is more closely tied to climate than fireplace consumption. The FortisBC REUS contains more detailed consumption data on two types of gas fireplace: heater-type fireplaces and decorative fireplaces. The UEC used in the model is a weighted average of the two.

Other

A variety of other gas end uses are found in the homes of FortisBC residential customers, including gas barbecues, spa/hot tub heaters, outdoor fireplaces or campfires, garage or patio heaters, and outdoor gas lights. These end uses each account for a small portion of FortisBC's residential load and are therefore not modeled separately. The model does not specifically track other end uses consuming fuels other than natural gas or electricity. For example, propane barbecues, which represent a fuel switching option, would require special attention because their propane fuel use is not included in the Reference Case.

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[28] Personal communication, Skip Hayden, Group Leader - Integrated Energy Systems, NRCan.

Electric End Uses

Marbek's energy model tracks energy consumption for both electricity and natural gas. Several electrical end uses, such as furnace fans and air conditioning systems, are directly affected by some of the efficiency measures applicable to natural gas space heating. The electrical savings attributable to these measures are factored into the measure TRC results found in Section 4.

Appliance Saturation

Exhibit A 13, Exhibit A 14, Exhibit A 15, Exhibit A 16, and Exhibit A 17 summarize the saturation levels assumed in the present analysis for the five regions. Saturation percentages combine the percentage of homes that contain a given appliance with the average number of such appliances found. Gas end uses that are assumed to be present in all homes include space heating, DHW, cooking, and other. The saturations for those end uses are not presented in the exhibits.

The assumed saturation levels are developed from the 2008 FortisBC REUS.

Exhibit A 13 Appliance Saturation Levels for the Lower Mainland Region, Base Year (%)

Dwelling Types	Fireplace	Clothes dryer	Pool & spa heaters
SFD/Duplex, gas heat, pre-1976	89%	92%	17%
SFD/Duplex, gas heat, 1976 or newer	89%	92%	17%
SFD/Duplex, non-gas heat, pre-1976	89%	92%	17%
SFD/Duplex, non-gas heat, 1976 or newer	89%	92%	17%
Attached/Row, gas heat, pre-1976	79%	91%	5%
Attached/Row, gas heat, 1976 or newer	79%	91%	5%
Attached/Row, non-gas heat, pre-1976	79%	91%	5%
Attached/Row, non-gas heat, 1976 or newer	79%	91%	5%
Mobile/other, gas heat	79%	91%	5%
Mobile/other, non-gas heat	79%	91%	5%

Exhibit A 14 Appliance Saturation Levels for the Vancouver Island Region, Base Year (%)

Dwelling Types	Fireplace	Clothes dryer	Pool & spa heaters
SFD/Duplex, gas heat, pre-1976	91%	95%	14%
SFD/Duplex, gas heat, 1976 or newer	91%	95%	14%
SFD/Duplex, non-gas heat, pre-1976	91%	95%	14%
SFD/Duplex, non-gas heat, 1976 or newer	91%	95%	14%
Attached/Row, gas heat, pre-1976	81%	94%	4%
Attached/Row, gas heat, 1976 or newer	81%	94%	4%
Attached/Row, non-gas heat, pre-1976	81%	94%	4%
Attached/Row, non-gas heat, 1976 or newer	81%	94%	4%
Mobile/other, gas heat	81%	94%	4%
Mobile/other, non-gas heat	81%	94%	4%

Exhibit A 15 Appliance Saturation Levels for the Southern Interior Region, Base Year (%)

Dwelling Types	Fireplace	Clothes dryer	Pool & spa heaters
SFD/Duplex, gas heat, pre-1976	78%	94%	23%
SFD/Duplex, gas heat, 1976 or newer	78%	94%	23%
SFD/Duplex, non-gas heat, pre-1976	78%	94%	23%
SFD/Duplex, non-gas heat, 1976 or newer	78%	94%	23%
Attached/Row, gas heat, pre-1976	69%	93%	7%
Attached/Row, gas heat, 1976 or newer	69%	93%	7%
Attached/Row, non-gas heat, pre-1976	69%	93%	7%
Attached/Row, non-gas heat, 1976 or newer	69%	93%	7%
Mobile/other, gas heat	69%	93%	7%
Mobile/other, non-gas heat	69%	93%	7%

Exhibit A 16 Appliance Saturation Levels for the Northern Interior Region, Base Year (%)

Dwelling Types	Fireplace	Clothes dryer	Pool & spa heaters
SFD/Duplex, gas heat, pre-1976	48%	98%	9%
SFD/Duplex, gas heat, 1976 or newer	48%	98%	9%
SFD/Duplex, non-gas heat, pre-1976	48%	98%	9%
SFD/Duplex, non-gas heat, 1976 or newer	48%	98%	9%
Attached/Row, gas heat, pre-1976	43%	96%	3%
Attached/Row, gas heat, 1976 or newer	43%	96%	3%
Attached/Row, non-gas heat, pre-1976	43%	96%	3%
Attached/Row, non-gas heat, 1976 or newer	43%	96%	3%
Mobile/other, gas heat	43%	96%	3%
Mobile/other, non-gas heat	43%	96%	3%

Exhibit A 17 Appliance Saturation Levels for the Whistler Region, Base Year (%)

Dwelling Types	Fireplace	Clothes dryer	Pool & spa heaters
SFD/Duplex, gas heat, pre-1976	99%	94%	52%
SFD/Duplex, gas heat, 1976 or newer	99%	94%	52%
SFD/Duplex, non-gas heat, pre-1976	99%	94%	52%
SFD/Duplex, non-gas heat, 1976 or newer	99%	94%	52%
Attached/Row, gas heat, pre-1976	95%	92%	15%
Attached/Row, gas heat, 1976 or newer	95%	92%	15%
Attached/Row, non-gas heat, pre-1976	95%	92%	15%
Attached/Row, non-gas heat, 1976 or newer	95%	92%	15%
Mobile/other, gas heat	95%	92%	15%
Mobile/other, non-gas heat	95%	92%	15%

Natural Gas Fuel Share

Exhibit A 18, Exhibit A 19, Exhibit A 20, Exhibit A 21, and Exhibit A 22 summarize the natural gas fuel shares assumed in the present analysis for the five regions. The assumed natural gas fuel shares were developed from the 2008 FortisBC REUS.

For this CPR, only FortisBC customers are included in the analysis. All houses in the housing segments that do not use natural gas for space heating are, therefore, FortisBC customers who use gas for some other end uses. The REUS provided sufficiently detailed data to use different gas fuel shares for the DHW in houses with and without gas as the primary space heating fuel. For other end uses, the same fuel shares were used in houses with and without gas as the primary space heating fuel. Other gas uses, by definition, always have 100% natural gas fuel share, so it has been omitted from these exhibits.

The space heating fuel shares are handled primarily through the segmentation of the housing stock into gas-heated and non-gas-heated homes. However, the data also confirm that supplemental heating is widespread in both electric and natural gas heated dwellings.

The more difficult issue is determining the amount of heating load that is met by:[29]

- Electricity in non-electrically heated dwellings (primarily natural gas)
- Non-electric sources in electrically heated dwellings.

The space heating fuel shares presented in these exhibits have been selected on the basis that they provide a reasonable fit with:

- The information on supplementary heating in the REUS
- Customer billing data
- General market description (i.e., known distribution of heating appliances by fuel).

[29] Due to the prevalence of more than one heating system, actual space heating fuel shares can vary from year to year based on prevailing natural gas and electricity rates in the period.

Exhibit A 18 Natural Gas Fuel Shares for the Lower Mainland Region, Base Year (%)

Dwelling Types	Space heating	Domestic hot water (DHW)	Fireplace	Cooking	Clothes dryer	Pool & spa heaters
SFD/Duplex, gas heat, pre-1976	95%	92%	64%	24%	6%	45%
SFD/Duplex, gas heat, 1976 or newer	95%	92%	64%	24%	6%	45%
SFD/Duplex, non-gas heat, pre-1976	5%	69%	64%	24%	6%	45%
SFD/Duplex, non-gas heat, 1976 or newer	5%	69%	64%	24%	6%	45%
Attached/Row, gas heat, pre-1976	95%	92%	85%	18%	4%	45%
Attached/Row, gas heat, 1976 or newer	95%	92%	85%	18%	4%	45%
Attached/Row, non-gas heat, pre-1976	8%	69%	85%	18%	4%	45%
Attached/Row, non-gas heat, 1976 or newer	8%	69%	85%	18%	4%	45%
Mobile/other, gas heat	95%	92%	66%	23%	5%	45%
Mobile/other, non-gas heat	5%	69%	66%	23%	5%	45%

Exhibit A 19 Natural Gas Fuel Shares for the Vancouver Island Region, Base Year (%)

Dwelling Types	Space heating	Domestic hot water (DHW)	Fireplace	Cooking	Clothes dryer	Pool & spa heaters
SFD/Duplex, gas heat, pre-1976	72%	86%	73%	27%	14%	8%
SFD/Duplex, gas heat, 1976 or newer	72%	86%	73%	27%	14%	8%
SFD/Duplex, non-gas heat, pre-1976	23%	64%	73%	27%	14%	8%
SFD/Duplex, non-gas heat, 1976 or newer	23%	64%	73%	27%	14%	8%
Attached/Row, gas heat, pre-1976	72%	85%	89%	20%	9%	8%
Attached/Row, gas heat, 1976 or newer	72%	85%	89%	20%	9%	8%
Attached/Row, non-gas heat, pre-1976	17%	64%	89%	20%	9%	8%
Attached/Row, non-gas heat, 1976 or newer	17%	64%	89%	20%	9%	8%
Mobile/other, gas heat	72%	86%	74%	27%	14%	8%
Mobile/other, non-gas heat	23%	64%	74%	27%	14%	8%

Exhibit A 20 Natural Gas Fuel Shares for the Southern Interior Region, Base Year (%)

Dwelling Types	Space heating	Domestic hot water (DHW)	Fireplace	Cooking	Clothes dryer	Pool & spa heaters
SFD/Duplex, gas heat, pre-1976	83%	90%	60%	15%	6%	22%
SFD/Duplex, gas heat, 1976 or newer	83%	90%	60%	15%	6%	22%
SFD/Duplex, non-gas heat, pre-1976	5%	68%	60%	15%	6%	22%
SFD/Duplex, non-gas heat, 1976 or newer	5%	68%	60%	15%	6%	22%
Attached/Row, gas heat, pre-1976	83%	90%	80%	11%	4%	22%
Attached/Row, gas heat, 1976 or newer	83%	90%	80%	11%	4%	22%
Attached/Row, non-gas heat, pre-1976	8%	67%	80%	11%	4%	22%
Attached/Row, non-gas heat, 1976 or newer	8%	67%	80%	11%	4%	22%
Mobile/other, gas heat	83%	90%	61%	14%	6%	22%
Mobile/other, non-gas heat	5%	68%	61%	14%	6%	22%

Exhibit A 21 Natural Gas Fuel Shares for the Northern Interior Region, Base Year (%)

Dwelling Types	Space heating	Domestic hot water (DHW)	Fireplace	Cooking	Clothes dryer	Pool & spa heaters
SFD/Duplex, gas heat, pre-1976	94%	89%	49%	21%	9%	16%
SFD/Duplex, gas heat, 1976 or newer	94%	89%	49%	21%	9%	16%
SFD/Duplex, non-gas heat, pre-1976	2%	67%	49%	21%	9%	16%
SFD/Duplex, non-gas heat, 1976 or newer	2%	67%	49%	21%	9%	16%
Attached/Row, gas heat, pre-1976	94%	88%	64%	15%	6%	16%
Attached/Row, gas heat, 1976 or newer	94%	88%	64%	15%	6%	16%
Attached/Row, non-gas heat, pre-1976	7%	66%	64%	15%	6%	16%
Attached/Row, non-gas heat, 1976 or newer	7%	66%	64%	15%	6%	16%
Mobile/other, gas heat	94%	89%	49%	20%	9%	16%
Mobile/other, non-gas heat	2%	67%	49%	20%	9%	16%

Exhibit A 22 Natural Gas Fuel Shares for the Whistler Region, Base Year (%)

Dwelling Types	Space heating	Domestic hot water (DHW)	Fireplace	Cooking	Clothes dryer	Pool & spa heaters
SFD/Duplex, gas heat, pre-1976	95%	61%	56%	39%	8%	21%
SFD/Duplex, gas heat, 1976 or newer	95%	61%	56%	39%	8%	21%
SFD/Duplex, non-gas heat, pre-1976	5%	46%	56%	39%	8%	21%
SFD/Duplex, non-gas heat, 1976 or newer	5%	46%	56%	39%	8%	21%
Attached/Row, gas heat, pre-1976	95%	61%	74%	29%	5%	21%
Attached/Row, gas heat, 1976 or newer	95%	61%	74%	29%	5%	21%
Attached/Row, non-gas heat, pre-1976	9%	46%	74%	29%	5%	21%
Attached/Row, non-gas heat, 1976 or newer	9%	46%	74%	29%	5%	21%
Mobile/other, gas heat	95%	61%	61%	35%	7%	21%
Mobile/other, non-gas heat	5%	46%	61%	35%	7%	21%

Calibration of 2009 Sales Data and Adjustment to Study Base Year

FortisBC provided natural gas consumption per account for the year 2009, which was the latest year for which a complete year of data was available at the time of the study. Consumption per dwelling was multiplied by total number of residential accounts, and the resulting totals were divided among the dwelling types and vintages according to the best information available from the 2008 REUS and from Marbek's energy end-use modelling. The RSEEM model was populated with data for UEC, saturation, and gas fuel share, and calibrated for a close match to the 2009 data.

The Base Year of 2010 was chosen for the study, because no programs based on study results can begin early enough to have an effect on natural gas consumption in 2010. The 2009 model therefore had to be adjusted to provide a realistic estimate of natural gas end-use consumption in 2010 for all the dwelling types and end uses, calibrated to total consumption estimated in the FortisBC load forecast. Growth rates provided by FortisBC forecasting were applied to the 2009 numbers of dwellings. Adjustments were then made to UEC values to achieve calibration with the FortisBC consumption forecast.

Model results – Base Year energy use

Base year energy consumption is presented both on a per dwelling basis and as totals by region, end use, and dwelling type. The Lower Mainland values were presented in Section 3. Exhibit A 23, Exhibit A 24, Exhibit A 25, and Exhibit A 26 present the per dwelling values for the other four regions. Exhibit A 27, Exhibit A 28, Exhibit A 29, and Exhibit A 30 provide the regional totals for the other four regions.

Exhibit A 23 Average Natural Gas Use per Dwelling Unit for the Vancouver Island Region, Base Year (MJ/yr.)

Dwelling Types	Space heating	Domestic hot water (DHW)	Fireplace	Cooking	Clothes dryer	Pool & spa heaters	Other gas uses	Grand Total
SFD/Duplex, gas heat, pre-1976	39,182	13,054	11,218	1,227	499	306	951	66,437
SFD/Duplex, gas heat, 1976 or newer	31,998	13,054	11,218	1,227	499	306	951	59,253
SFD/Duplex, non-gas heat, pre-1976	12,030	9,803	11,218	1,227	499	306	951	36,034
SFD/Duplex, non-gas heat, 1976 or newer	9,824	9,803	11,218	1,227	499	306	951	33,828
Attached/Row, gas heat, pre-1976	21,325	11,482	7,364	808	277	88	847	42,192
Attached/Row, gas heat, 1976 or newer	17,426	11,482	7,364	808	277	88	847	38,293
Attached/Row, non-gas heat, pre-1976	3,882	8,623	7,364	808	277	88	847	21,890
Attached/Row, non-gas heat, 1976 or newer	3,172	8,623	7,364	808	277	88	847	21,180
Mobile/other, gas heat	20,641	11,308	6,161	1,042	477	88	829	40,546
Mobile/other, non-gas heat	6,439	8,492	6,161	1,042	477	88	829	23,528
Weighted Average	26,568	11,954	10,828	1,193	483	286	941	52,252

Exhibit A 24 Average Natural Gas Use per Dwelling Unit for the Southern Interior Region, Base Year (MJ/yr.)

Dwelling Types	Space heating	Domestic hot water (DHW)	Fireplace	Cooking	Clothes dryer	Pool & spa heaters	Other gas uses	Grand Total
SFD/Duplex, gas heat, pre-1976	46,624	13,485	8,032	671	206	1,378	689	71,086
SFD/Duplex, gas heat, 1976 or newer	39,436	13,485	8,032	671	206	1,378	689	63,898
SFD/Duplex, non-gas heat, pre-1976	2,838	10,127	8,032	671	206	1,378	689	23,942
SFD/Duplex, non-gas heat, 1976 or newer	2,400	10,127	8,032	671	206	1,378	689	23,504
Attached/Row, gas heat, pre-1976	27,869	11,309	6,233	422	115	397	613	46,958
Attached/Row, gas heat, 1976 or newer	24,685	11,309	6,233	422	115	397	613	43,774
Attached/Row, non-gas heat, pre-1976	2,305	8,493	6,233	422	115	397	613	18,578
Attached/Row, non-gas heat, 1976 or newer	2,042	8,493	6,233	422	115	397	613	18,314
Mobile/other, gas heat	30,872	11,740	4,782	578	189	397	601	49,158
Mobile/other, non-gas heat	1,903	8,816	4,782	578	189	397	601	17,265
Weighted Average	37,854	13,060	7,786	654	201	1,282	681	61,518

Exhibit A 25 Average Natural Gas Use per Dwelling Unit for the Northern Interior Region, Base Year (MJ/yr.)

Dwelling Types	Space heating	Domestic hot water (DHW)	Fireplace	Cooking	Clothes dryer	Pool & spa heaters	Other gas uses	Grand Total
SFD/Duplex, gas heat, pre-1976	98,993	15,264	3,337	1,058	363	415	802	120,232
SFD/Duplex, gas heat, 1976 or newer	83,732	15,264	3,337	1,058	363	415	802	104,971
SFD/Duplex, non-gas heat, pre-1976	2,047	11,463	3,337	1,058	363	415	802	19,484
SFD/Duplex, non-gas heat, 1976 or newer	1,731	11,463	3,337	1,058	363	415	802	19,169
Attached/Row, gas heat, pre-1976	59,172	12,801	2,590	664	202	119	714	76,262
Attached/Row, gas heat, 1976 or newer	52,412	12,801	2,590	664	202	119	714	69,502
Attached/Row, non-gas heat, pre-1976	3,511	9,613	2,590	664	202	119	714	17,413
Attached/Row, non-gas heat, 1976 or newer	3,110	9,613	2,590	664	202	119	714	17,012
Mobile/other, gas heat	65,548	13,289	1,988	911	328	119	700	82,882
Mobile/other, non-gas heat	1,372	9,979	1,988	911	328	119	700	15,397
Weighted Average	80,134	14,783	3,235	1,031	353	386	793	100,714

Exhibit A 26 Average Natural Gas Use per Dwelling Unit for the Whistler Region, Base Year (MJ/yr.)

Dwelling Types	Space heating	Domestic hot water (DHW)	Fireplace	Cooking	Clothes dryer	Pool & spa heaters	Other gas uses	Grand Total
SFD/Duplex, gas heat, pre-1976	98,014	13,206	13,537	2,306	353	2,993	2,474	132,884
SFD/Duplex, gas heat, 1976 or newer	82,904	13,206	13,537	2,306	353	2,993	2,474	117,774
SFD/Duplex, non-gas heat, pre-1976	5,620	9,917	13,537	2,306	353	2,993	2,474	37,202
SFD/Duplex, non-gas heat, 1976 or newer	4,754	9,917	13,537	2,306	353	2,993	2,474	36,335
Attached/Row, gas heat, pre-1976	58,587	11,075	11,294	1,448	196	862	2,203	85,664
Attached/Row, gas heat, 1976 or newer	51,894	11,075	11,294	1,448	196	862	2,203	78,971
Attached/Row, non-gas heat, pre-1976	4,331	8,317	11,294	1,448	196	862	2,203	28,650
Attached/Row, non-gas heat, 1976 or newer	3,836	8,317	11,294	1,448	196	862	2,203	28,155
Mobile/other, gas heat	64,900	11,497	9,434	1,839	284	862	2,158	90,973
Mobile/other, non-gas heat	3,768	8,634	9,434	1,839	284	862	2,158	26,978
Weighted Average	51,039	11,467	12,744	2,013	300	2,256	2,380	82,199

Exhibit A 27 Natural Gas Consumption for the Vancouver Island Region, Modelled by End Use and Dwelling Type, Base Year (1000 GJ/yr.)

Dwelling Types	Space heating	Domestic hot water (DHW)	Fireplace	Cooking	Clothes dryer	Pool & spa heaters	Other gas uses	Grand Total	% of Total
SFD/Duplex, gas heat, pre-1976	951	317	272	30	23	12	7	1,613	34%
SFD/Duplex, gas heat, 1976 or newer	1,081	426	379	41	32	17	10	1,987	42%
SFD/Duplex, non-gas heat, pre-1976	122	100	114	12	10	5	3	366	8%
SFD/Duplex, non-gas heat, 1976 or newer	139	134	159	17	13	7	4	474	10%
Attached/Row, gas heat, pre-1976	13	7	4	0	1	0	0	25	1%
Attached/Row, gas heat, 1976 or newer	70	43	30	3	3	1	0	151	3%
Attached/Row, non-gas heat, pre-1976	1	2	2	0	0	0	0	5	0%
Attached/Row, non-gas heat, 1976 or newer	5	14	12	1	1	0	0	35	1%
Mobile/other, gas heat	29	16	9	1	1	1	0	58	1%
Mobile/other, non-gas heat	4	5	4	1	0	0	0	14	0%
Total	2,416	1,064	985	108	86	44	26	4,728	100%
% of Total	51%	23%	21%	2%	2%	1%	1%	100%	

Exhibit A 28 Natural Gas Consumption for the Southern Interior Region, Modelled by End Use and Dwelling Type, Base Year (1000 GJ/yr.)

Dwelling Types	Space heating	Domestic hot water (DHW)	Fireplace	Cooking	Clothes dryer	Pool & spa heaters	Other gas uses	Grand Total	% of Total
SFD/Duplex, gas heat, pre-1976	1,981	573	341	59	29	29	9	3,020	33%
SFD/Duplex, gas heat, 1976 or newer	3,224	1,102	657	113	56	55	17	5,223	57%
SFD/Duplex, non-gas heat, pre-1976	9	32	26	4	2	2	1	77	1%
SFD/Duplex, non-gas heat, 1976 or newer	15	62	49	8	4	4	1	145	2%
Attached/Row, gas heat, pre-1976	21	9	5	0	0	0	0	36	0%
Attached/Row, gas heat, 1976 or newer	153	70	39	2	4	3	1	272	3%
Attached/Row, non-gas heat, pre-1976	0	0	0	0	0	0	0	1	0%
Attached/Row, non-gas heat, 1976 or newer	1	4	3	0	0	0	0	9	0%
Mobile/other, gas heat	203	77	31	3	4	4	1	323	4%
Mobile/other, non-gas heat	1	4	2	0	0	0	0	9	0%
Total	5,608	1,935	1,153	190	101	97	30	9,113	100%
% of Total	62%	21%	13%	2%	1%	1%	0%	100%	

Exhibit A 29 Natural Gas Consumption for the Northern Interior Region, Modelled by End Use and Dwelling Type, Base Year (1000 GJ/yr.)

Dwelling Types	Space heating	Domestic hot water (DHW)	Fireplace	Cooking	Clothes dryer	Pool & spa heaters	Other gas uses	Grand Total	% of Total
SFD/Duplex, gas heat, pre-1976	2,383	367	80	25	19	10	9	2,894	34%
SFD/Duplex, gas heat, 1976 or newer	3,878	707	155	49	37	19	17	4,861	58%
SFD/Duplex, non-gas heat, pre-1976	4	21	6	2	1	1	1	35	0%
SFD/Duplex, non-gas heat, 1976 or newer	6	40	12	4	3	1	1	67	1%
Attached/Row, gas heat, pre-1976	25	6	1	0	0	0	0	33	0%
Attached/Row, gas heat, 1976 or newer	184	45	9	2	3	0	1	245	3%
Attached/Row, non-gas heat, pre-1976	0	0	0	0	0	0	0	1	0%
Attached/Row, non-gas heat, 1976 or newer	1	3	1	0	0	0	0	5	0%
Mobile/other, gas heat	244	49	7	3	3	0	1	309	4%
Mobile/other, non-gas heat	0	3	1	0	0	0	0	4	0%
Total	6,726	1,241	271	87	67	32	30	8,453	100%
% of Total	80%	15%	3%	1%	1%	0%	0%	100%	

Exhibit A 30 Natural Gas Consumption for the Whistler Region, Modelled by End Use and Dwelling Type, Base Year (1000 GJ/yr.)

Dwelling Types	Space heating	Domestic hot water (DHW)	Fireplace	Cooking	Clothes dryer	Pool & spa heaters	Other gas uses	Grand Total	% of Total
SFD/Duplex, gas heat, pre-1976	10	1	1	0	0	0	0	13	7%
SFD/Duplex, gas heat, 1976 or newer	76	12	12	2	3	2	0	107	57%
SFD/Duplex, non-gas heat, pre-1976	0	1	0	0	0	0	0	2	1%
SFD/Duplex, non-gas heat, 1976 or newer	2	6	4	1	1	1	0	16	8%
Attached/Row, gas heat, pre-1976	1	0	0	0	0	0	0	1	1%
Attached/Row, gas heat, 1976 or newer	26	6	6	1	0	1	0	40	21%
Attached/Row, non-gas heat, pre-1976	0	0	0	0	0	0	0	0	0%
Attached/Row, non-gas heat, 1976 or newer	1	3	2	1	0	0	0	7	4%
Mobile/other, gas heat	1	0	0	0	0	0	0	1	1%
Mobile/other, non-gas heat	0	0	0	0	0	0	0	0	0%
Total	117	29	26	5	5	5	1	188	100%
% of Total	62%	16%	14%	3%	3%	2%	0%	100%	

Appendix B Background - Section 4: Reference Case Natural Gas Forecast

Introduction

This appendix provides background supporting information for the natural gas forecast presented in Section 4. The discussion is organized into the following sub sections:

- Estimation of net space heating loads in new dwellings
- Growth of building stock
- “Natural” changes to space heating loads in existing dwellings
- “Natural” changes to appliance and heating energy use
- Appliance saturation trends
- Fuel share trends
- Model results.

Estimation of Net Space Heating Loads—New Dwellings

The first task in building the Reference Case involves the development of thermal archetypes for the new stock. As was the case with existing stock, the archetypes were based to a large extent on the HOT2000 simulations of archetypal buildings originally developed for the 2006 BC Hydro study. Two major data sources were referenced:

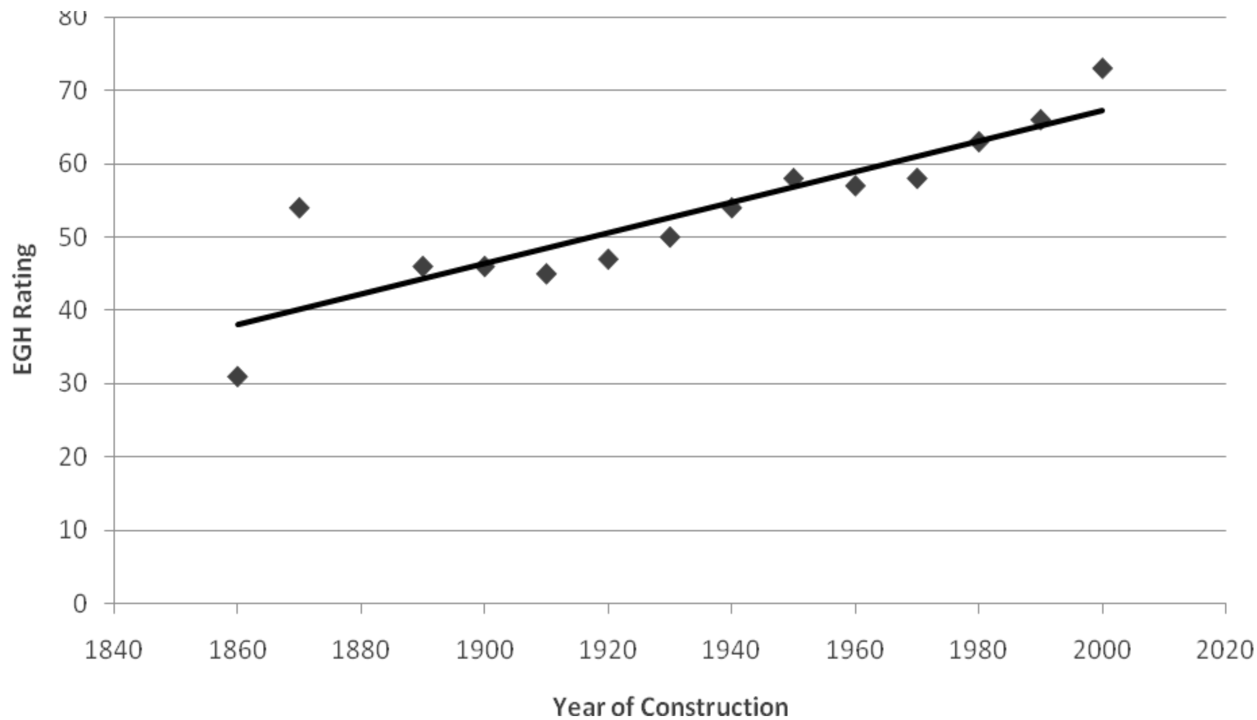
- The EnerGuide for Houses database
- The BC Building Code.

The current BC Building Code establishes a target energy performance of EnerGuide 80 for newly constructed houses beginning late in 2011. Current construction practices are designed to produce houses with performance of approximately EnerGuide 77.

Trends in British Columbia Residential Space Heating Loads

Exhibit B 1 provides a summary of trends in the thermal performance of British Columbia dwellings based on the results of 1,300 EnerGuide for Houses audits.

Exhibit B 1 Trends in B.C. Housing Efficiency Rating



As illustrated in Exhibit B 1, the thermal performance of British Columbia housing stock has been improving steadily with each new generation of construction. The thermal performance of new construction is therefore already considerably above the average existing dwelling, even in the newer (1976-present) vintage category. The new target of EnerGuide 80 increases this improvement further.

Overall space heating loads for the Lower Mainland will continue to be larger than for the other two regions, primarily because houses are expected to continue to be larger, on average, than in the other regions.

The amount of window area in new houses, as a percentage of the total exterior wall area, has increased by up to 30% relative to homes constructed in earlier periods.

In the Lower Mainland and Interior regions, the new stock tends to have floor areas that are 10% larger, on average; these same buildings also feature a 20% increase in exterior wall surface area as the result of the more complex wall geometry used in many of the new designs. The trend towards increased floor area appears to have levelled off, as shown in Exhibit A 1.

Window thermal efficiency has increased and air leakage rates have been reduced. U-value (heat loss factor) in windows has been reduced by approximately a factor of two over the course of a gradual evolution from old double-glazed wood-frame windows with no thermal break to current thermally-broken vinyl-framed windows with double-paned low-E glass. Overall air leakage in B.C. homes has decreased by approximately a factor of two in the last 80 years. Tighter windows account for a significant portion of this improvement.

The net effect of the above trends is that while thermal efficiencies are improving, they are being partially offset by changing construction practices.

Net Space Heating Loads Used in This Study

A summary of the net space heating loads used in this Reference Case for new residential dwellings are presented in Exhibit 12 in Section 4.

Growth of Building Stock

The next step in developing the Reference Case involved the development and application of estimated levels of growth in each building segment and service region over the study period. The stock growth rates are based primarily on the FortisBC 2010 Long Term Resource Plan. In addition, the data on age of construction for different kinds of housing in the 2008 REUS were used to establish the relative growth rates of multi-family (attached) housing versus single detached houses. Since 1950, attached homes have grown at approximately 2.95 times the rate of detached homes in the FortisBC service area.

In most service regions, dwellings with natural gas as the primary heating fuel and dwellings with other fuels as the primary heating fuel are assumed to grow at approximately the same rate. In the Vancouver Island service region, however, the predominant type of new residential customer is expected to use natural gas mainly for a gas fireplace, and not for DHW or space heating. Consequently, the model has been adjusted so that the majority of growth in dwelling units in Vancouver Island is in the dwellings that do not use natural gas as their main space heating fuel.

Exhibit B 2 presents a summary of the growth rates employed in this Reference Case, by region, dwelling type and primary space heating fuel.

Exhibit B 2 Annual Growth Rates in Period by Building Segment and FortisBC Service Region, (%)

Regions	Dwelling Types	Annualized Stock Growth Rates by Period			
		2010-2015	2015-2020	2020-2025	2025-2030
Lower Mainland	SFD/Duplex, gas heat	2.7%	2.3%	2.0%	1.8%
	SFD/Duplex, non-gas heat	2.7%	2.3%	2.0%	1.8%
	Attached/Row, gas heat	8.1%	6.8%	5.8%	5.2%
	Attached/Row, non-gas heat	8.1%	6.8%	5.8%	5.2%
	Mobile/other, gas heat	3.3%	2.8%	2.4%	2.2%
	Mobile/other, non-gas heat	3.3%	2.8%	2.4%	2.2%
Vancouver Island	SFD/Duplex, gas heat	13.6%	9.7%	6.8%	5.9%
	SFD/Duplex, non-gas heat	13.6%	9.7%	6.8%	5.9%
	Attached/Row, gas heat	40.2%	28.5%	20.0%	17.4%
	Attached/Row, non-gas heat	40.2%	28.5%	20.0%	17.4%
	Mobile/other, gas heat	15.6%	11.4%	8.1%	7.2%
	Mobile/other, non-gas heat	15.6%	11.4%	8.1%	7.2%
Southern Interior	SFD/Duplex, gas heat	4.8%	3.8%	2.9%	2.5%
	SFD/Duplex, non-gas heat	4.8%	3.8%	2.9%	2.5%
	Attached/Row, gas heat	14.2%	11.1%	8.4%	7.3%
	Attached/Row, non-gas heat	14.2%	11.1%	8.4%	7.3%
	Mobile/other, gas heat	5.3%	4.2%	3.2%	2.8%
	Mobile/other, non-gas heat	5.3%	4.2%	3.2%	2.8%
Northern Interior	SFD/Duplex, gas heat	4.8%	3.8%	2.9%	2.5%
	SFD/Duplex, non-gas heat	4.8%	3.8%	2.9%	2.5%
	Attached/Row, gas heat	14.2%	11.1%	8.4%	7.3%
	Attached/Row, non-gas heat	14.2%	11.1%	8.4%	7.3%
	Mobile/other, gas heat	5.3%	4.2%	3.2%	2.8%
	Mobile/other, non-gas heat	5.3%	4.2%	3.2%	2.8%
Whistler	SFD/Duplex, gas heat	3.7%	2.7%	1.7%	1.4%
	SFD/Duplex, non-gas heat	3.7%	2.7%	1.7%	1.4%
	Attached/Row, gas heat	11.0%	8.1%	5.0%	4.0%
	Attached/Row, non-gas heat	11.0%	8.1%	5.0%	4.0%
	Mobile/other, gas heat	6.2%	4.6%	2.9%	2.3%
	Mobile/other, non-gas heat	6.2%	4.6%	2.9%	2.3%

Demolition Rates

Rates of demolition of older residential dwellings have been neglected in this analysis.

"Natural" Changes to Space Heating Loads—Existing Dwellings

In addition to new dwellings, space heating loads in existing dwellings are also expected to change over the study period. However, no specific data are available and, as outlined in the preceding discussion of new dwellings, contrary trends[30] are occurring.

Examples of trends that tend to decrease the net space heating loads include:

- Insulation and other improvements that occur when renovation projects are undertaken
- Replacement of old windows with new models that provide comfort and aesthetic benefits as well as improved energy efficiency

[30] Replacement of the heating equipment itself is not one of these factors because it does not actually change the net heating load.

- Installation of more efficient thermostatic controls.

Examples of trends that tend to increase net space heating loads include:

- Enlargement of houses with additions
- Reductions in internal gains due to more efficient appliances and lights.

Dwellings that undergo a major energy retrofit to the building shell are moved from the existing dwelling category into renovated dwellings. On average, these projects are assumed to include two envelope retrofits (though they may not all happen in the same month), such as replacement of half of the windows and the addition of insulation to the attic. In past projects, window replacement has been used as an indicator of the percentage of dwellings being renovated. Window sales are typically divided roughly evenly between installation in new homes and replacement in existing homes. A typical window replacement project involves approximately half the windows in the dwelling. Therefore, the rate of renovation is approximately double the rate of new construction.

Trial energy simulation runs were undertaken in HOT2000, assuming a variety of combinations of retrofit measures. The results varied widely, from a 2% to 15% reduction in space heat and cooling loads, depending on assumptions related to the number of windows replaced, or the part of the house being insulated. These increases will be partly or wholly offset in those renovation jobs that also increase the floor area of the dwelling.

In the absence of more comprehensive data, this study assumes that a renovation to a home built after 1980 would experience a net reduction in space heating load of 3%. An older home (in which it was assumed to be more likely that there would be an addition to the floor area) would experience a net reduction in space heating load of 2%.

"Natural" Changes to Appliance and Heating Energy Use

Overview

Changes in the annual energy consumption of residential appliances and heating equipment result from improvements in the energy efficiency of new models and the gradual penetration of those new, more efficient models into the stock of new and existing residences.

New energy-efficiency regulations affect replacement of natural gas furnaces and tank water heaters in British Columbia homes. This Reference Case assumes the performance of this equipment will improve accordingly, as the existing stock is replaced at its normal rate throughout the study period.

Data available from NRCan[31] show that significant improvements occurred in the energy efficiency of new appliances and heating equipment during the late 1980s and mid 1990s, but in the period post-1997 the efficiency of new natural gas appliances (clothes dryers and cooking ranges) has remained relatively unchanged. This Reference Case assumes that, in the absence of new initiatives, further improvements in the gas consumption of new gas dryers and ranges will track the improvement in the electricity consumption of the corresponding electric appliances, as the existing stock is replaced over the study period.

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[31] Natural Resource Canada, *Energy Use Data Handbook, 2005.* p. 38-39.

Further discussion of assumptions applied to the major natural gas appliance appliances and heating equipment is provided below. The discussion is organized as follows:

- Furnaces
- Domestic Hot Water
- Cooking Ranges
- Clothes Dryers
- Fireplaces
- Pool Heaters
- Other.

Furnaces

Replacement furnaces must have a minimum efficiency of 90% as of December 31, 2009. This analysis assumes that furnaces last an average of 18 years, so that on average 1/18th of the furnaces in the existing dwellings will be replaced. All the furnaces in the FortisBC service area are therefore expected to be at least 90% efficient well before the end of the study period.

Domestic Hot Water

Exhibit B 3 summarizes the DHW percentage consumption by end use for dwellings in 2030. A comparison with the values presented previously for existing dwellings (see Section 2) shows the greatest reductions for hot water use in dishwashing and clothes washing. Slightly more modest changes have been assumed for personal consumption.

Superimposed on the reductions in DHW consumption are improvements in the equipment itself. DHW energy consumption for new tank heaters will improve over the study period because of new regulations in B.C. that took effect September 1, 2010. As an example, for a 151 litre (40-gal) tank, the energy factor must be at least 0.62. The minimum efficiency factor has previously risen from 0.52 for a 200-litre tank as of 1995, to 0.57 for a 200-litre tank as of 2003.[32] The new regulations therefore represent a significant improvement.

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[32] Office of Energy Efficiency, Regulations Bulletin, Sept. 2004.

Exhibit B 3 Distribution of DHW Use by End Use in 2030, (%)

DHW Sub End Uses	Natural Gas per Sub End Use (MJ)	Natural Gas per Sub End Use (%)
Clothes washer	3,369	23%
Dishwasher	3,086	21%
Faucets	2,619	18%
Showers	1,937	13%
Tank (standby) losses	1,360	9%
Leaks	1,020	7%
Pipe losses	735	5%
Baths	680	5%
Total	14,805	100%

Cooking Ranges

As outlined in the overview above, the primary contribution to reduced natural gas consumption in cooking ranges will come from the gradual penetration of new, more efficient models into the stock of new and existing residences. Marbek has developed an appliance model that tracks and forecasts the replacement of appliances and the resulting stock averages over time. This Reference Case assumes that the current gas cooking UEC declines (in a straight line) by 32% by the final milestone year. The variation of UECs by dwelling type and region (primarily based on occupancy) remains the same.

Clothes Dryers

As outlined in the overview above, the primary contribution to reduced natural gas consumption in clothes dryers will come from the gradual penetration of new, more efficient models into the stock of new and existing residences. Marbek has developed an appliance model that tracks and forecasts the replacement of appliances and the resulting stock averages over time. This Reference Case assumes that the current gas dryer UEC declines (in a straight line) by 5% by the final milestone year. The variation of UECs by dwelling type and region (primarily based on occupancy) remains the same.

Fireplaces

Fireplaces currently have a very wide range of efficiencies, and the average efficiency of units currently sold has not been extensively studied. An unpublished presentation by NRCan shows an average efficiency of approximately 60% in sales across Canada. In the absence of any new initiatives, the average UEC was not assumed to change during the study period.

Pool Heaters

The UEC for pool heaters is not expected to change during the study period in the absence of any new initiatives.

Other

In the absence of any new initiatives, other gas uses (spas, barbecues, etc.) were not assumed to change during the study period.

Appliance Saturation Trends

There are noticeable trends in the saturation of a number of electrical appliances, such as dishwashers, computers, and set-top boxes. These changes do not directly impact natural gas consumption, however, and therefore are not considered further in this analysis.

Fuel Share Trends

Fuel share data are taken directly from the 2008 REUS. No changes to them are considered in this analysis.

Model Results

Exhibit B 4, Exhibit B 5, Exhibit B 6, Exhibit B 7, and Exhibit B 8 present the model results in tabular form, by dwelling type, end use and milestone year for each of the five regions.

Exhibit B 4 Reference Case Forecast, Lower Mainland Region, (1000 GJ/yr.)

Dwelling Types	Milestone Years	Space heating	Domestic hot water (DHW)	Fireplace	Pool & spa heaters	Cooking	Clothes dryer	Other gas uses	TOTAL	% of Total
Single Family Dwelling	2010	29,999	8,907	6,818	957	625	111	509	47,925	92%
	2015	27,948	8,254	7,005	983	585	112	1,150	46,037	92%
	2020	27,589	7,847	7,168	1,006	565	114	1,818	46,107	92%
	2025	27,164	7,078	7,308	1,025	501	114	2,507	45,698	91%
	2030	26,670	6,555	7,437	1,043	464	115	3,217	45,502	91%
Attached Dwelling	2010	1,794	893	553	31	47	7	51	3,375	6%
	2015	1,748	869	597	34	46	7	122	3,424	7%
	2020	1,801	860	638	36	47	8	201	3,591	7%
	2025	1,844	807	675	38	43	8	288	3,703	7%
	2030	1,876	772	710	40	41	9	382	3,830	8%
Mobile/Other Dwelling	2010	378	169	81	6	12	2	10	657	1%
	2015	355	157	84	6	11	2	22	637	1%
	2020	353	150	86	6	11	2	35	643	1%
	2025	349	136	88	7	9	2	48	640	1%
	2030	345	127	90	7	9	2	62	641	1%
TOTAL	2010	32,171	9,969	7,452	994	684	120	570	51,958	
	2015	30,051	9,280	7,686	1,023	642	122	1,293	50,098	
	2020	29,743	8,857	7,892	1,048	622	124	2,054	50,341	
	2025	29,357	8,022	8,071	1,070	553	125	2,844	50,041	
	2030	28,891	7,454	8,236	1,090	514	126	3,662	49,972	
% of Total		58%	15%	16%	2%	1%	0%	7%	100%	

Exhibit B 5 Reference Case Forecast, Vancouver Island Region, (1000 GJ/yr.)

Dwelling Types	Milestone Years	Space heating	Domestic hot water (DHW)	Fireplace	Pool & spa heaters	Cooking	Clothes dryer	Other gas uses	TOTAL	% of Total
Single Family Dwelling	2010	2,293	977	924	25	101	41	78	4,440	94%
	2015	2,401	912	1,050	29	105	46	89	4,631	93%
	2020	2,556	870	1,151	31	108	50	98	4,865	92%
	2025	2,668	786	1,229	34	101	53	104	4,974	92%
	2030	2,769	728	1,302	36	97	55	110	5,097	91%
Attached Dwelling	2010	89	66	48	1	5	2	6	216	5%
	2015	114	66	68	1	7	3	8	265	5%
	2020	142	67	87	1	8	3	10	318	6%
	2025	168	64	104	1	9	4	12	361	7%
	2030	195	63	122	1	9	4	14	409	7%
Mobile/Other Dwelling	2010	33	21	12	0	2	1	2	71	2%
	2015	36	19	14	0	2	1	2	75	2%
	2020	39	19	16	0	2	1	2	80	2%
	2025	41	17	17	0	2	1	2	82	2%
	2030	44	16	19	0	2	1	3	84	2%
TOTAL	2010	2,416	1,064	985	26	108	44	86	4,728	
	2015	2,550	997	1,132	30	114	50	99	4,971	
	2020	2,738	955	1,254	33	119	55	110	5,263	
	2025	2,877	867	1,351	35	111	58	119	5,417	
	2030	3,007	807	1,443	37	108	61	127	5,590	
% of Total		54%	14%	26%	1%	2%	1%	2%	100%	

Exhibit B 6 Reference Case Forecast, Southern Interior Region, (1000 GJ/yr.)

Dwelling Types	Milestone Years	Space heating	Domestic hot water (DHW)	Fireplace	Pool & spa heaters	Cooking	Clothes dryer	Other gas uses	TOTAL	% of Total
Single Family Dwelling	2010	5,228	1,770	1,073	184	90	28	92	8,465	93%
	2015	5,026	1,672	1,125	193	86	28	96	8,226	93%
	2020	5,056	1,610	1,167	200	84	29	100	8,246	92%
	2025	5,053	1,467	1,200	206	75	30	103	8,134	92%
	2030	5,030	1,368	1,230	211	70	30	105	8,045	92%
Attached Dwelling	2010	176	83	47	3	3	1	5	317	3%
	2015	183	85	53	3	3	1	5	334	4%
	2020	197	88	59	4	3	1	6	358	4%
	2025	208	85	64	4	3	1	6	372	4%
	2030	218	83	69	4	3	1	7	385	4%
Mobile/Other Dwelling	2010	204	82	34	3	4	1	4	332	4%
	2015	197	77	36	3	4	1	4	323	4%
	2020	200	75	37	3	4	1	5	325	4%
	2025	201	68	38	3	3	1	5	320	4%
	2030	201	64	39	3	3	1	5	317	4%
TOTAL	2010	5,608	1,935	1,153	190	97	30	101	9,113	
	2015	5,406	1,835	1,214	199	93	31	106	8,884	
	2020	5,452	1,773	1,263	207	91	32	111	8,929	
	2025	5,461	1,620	1,303	213	82	32	114	8,826	
	2030	5,449	1,515	1,338	219	76	33	117	8,747	
% of Total		62%	17%	15%	3%	1%	0%	1%	100%	

Exhibit B 7 Reference Case Forecast, Northern Interior Region, (1000 GJ/yr.)

Dwelling Types	Milestone Years	Space heating	Domestic hot water (DHW)	Fireplace	Pool & spa heaters	Cooking	Clothes dryer	Other gas uses	TOTAL	% of Total
Single Family Dwelling	2010	6,270	1,135	253	31	80	27	61	7,858	93%
	2015	6,090	1,072	265	33	76	28	64	7,628	93%
	2020	6,148	1,033	275	34	75	29	66	7,659	92%
	2025	6,166	941	282	35	67	30	68	7,589	92%
	2030	6,163	877	290	36	62	30	70	7,528	92%
Attached Dwelling	2010	211	53	11	1	3	1	3	282	3%
	2015	222	55	13	1	3	1	3	297	4%
	2020	240	56	14	1	3	1	4	318	4%
	2025	254	54	15	1	3	1	4	332	4%
	2030	267	53	16	1	3	1	4	345	4%
Mobile/Other Dwelling	2010	245	52	8	0	4	1	3	313	4%
	2015	239	50	8	1	3	1	3	305	4%
	2020	243	48	9	1	3	1	3	308	4%
	2025	245	44	9	1	3	1	3	306	4%
	2030	246	41	9	1	3	1	3	304	4%
TOTAL	2010	6,726	1,241	271	32	87	30	67	8,453	
	2015	6,550	1,177	286	34	83	31	70	8,230	
	2020	6,630	1,137	297	35	81	32	73	8,285	
	2025	6,665	1,039	307	36	73	32	75	8,227	
	2030	6,676	971	315	37	68	33	77	8,178	
% of Total		82%	12%	4%	0%	1%	0%	1%	100%	

Exhibit B 8 Reference Case Forecast, Whistler Region, (1000 GJ/yr.)

Dwelling Types	Milestone Years	Space heating	Domestic hot water (DHW)	Fireplace	Pool & spa heaters	Cooking	Clothes dryer	Other gas uses	TOTAL	% of Total
Single Family Dwelling	2010	88	18	20	4	3	1	4	138	74%
	2015	90	19	21	5	3	1	6	144	72%
	2020	92	19	22	5	3	1	7	149	71%
	2025	93	20	22	5	3	1	8	152	71%
	2030	94	20	22	5	3	1	9	154	70%
Attached Dwelling	2010	28	8	9	1	1	0	2	48	26%
	2015	31	9	10	1	1	0	3	54	27%
	2020	33	9	10	1	1	0	4	58	28%
	2025	34	10	11	1	1	0	4	62	29%
	2030	35	10	11	1	1	0	5	64	29%
Mobile/Other Dwelling	2010	1	0	0	0	0	0	0	2	1%
	2015	1	0	0	0	0	0	0	2	1%
	2020	1	0	0	0	0	0	0	2	1%
	2025	1	0	0	0	0	0	0	2	1%
	2030	1	0	0	0	0	0	0	2	1%
TOTAL	2010	117	26	29	5	5	1	5	188	
	2015	122	28	31	5	4	1	8	199	
	2020	126	29	32	6	4	1	11	209	
	2025	129	30	33	6	4	1	13	215	
	2030	131	30	34	6	4	1	15	220	
% of Total		60%	14%	15%	3%	2%	0%	7%	100%	

Appendix C

Background - Section 5: Efficiency and Alternative Energy Technologies

Introduction

Exhibit C 1 provides a sample TRC analysis table for the high-efficiency gas fireplaces measure. Further details on this measure are provided in the TRC Analysis Workbook, an Excel file that accompanies this report. Similar worksheets are provided for all the measures analyzed.

After the exhibit, descriptions of all the measures considered are provided.

Exhibit C 1 Sample TRC Calculation Worksheet

High-Efficiency Gas Fireplaces

Description:	All vented gas fireplaces sold in Canada must now be tested for their energy efficiency using the Canadian Standards Association CSA-P.4.1-02 standard if they are shipped across provincial lines. The energy-efficiency rating of the fireplace is printed on the EnerGuide label. EnerGuide does not set a minimum efficiency level, so savings are possible by using the EnerGuide label to choose the more efficient unit.
Baseline:	An average efficiency natural gas fireplace (60% assumed)
Upgrade:	A high-efficiency natural gas fireplace (80% assumed)

Baseline Reference:	1. Annual consumption, end use		= User Input
Heating Fuel Type:	All Fuels (Average Fuel Mix)		= Calculation
Main End Use:	Space Heating		
Discount Rate:	7.38%		
GHG Adder Incl.?	No		
Resource Costs:	Baseload		

	Customer Cost	Avoided Costs (NPV)							
Electricity ($/kWh)	$0.083	$1.226	$1.226	$1.226	$1.226	$1.226	$1.226	$1.226	$1.226
Electricity ($/kW)	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000
Natural Gas ($/MJ)	$0.010	$0.092	$0.092	$0.092	$0.092	$0.092	$0.092	$0.092	$0.092
Oil ($/L)	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000
Water ($/1000L)	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000

Sub-sector		Detached (Pre-1976)	Detached (Post-1976)	Detached (New)	Attached (Pre-1976)	Attached (Post-1976)	Attached (New)	Mobile (Existing)	Mobile (New)	Weighted Avg.
Baseline Consumption	Electricity (kWh/yr.)	-	-	-	-	-	-	-	-	-
	Natural Gas (MJ/yr.)	25,833	25,833	25,833	15,709	15,709	15,709	15,389	15,389	23,833
	Oil (L/yr.)	-	-	-	-	-	-	-	-	-
	Water (L/yr.)	-	-	-	-	-	-	-	-	-
Upgrade Consumption	Electricity (kWh/yr.)	-	-	-	-	-	-	-	-	-
	Natural Gas (MJ/yr.)	19,374	19,374	19,374	11,781	11,781	11,781	11,542	11,542	17,875
	Oil (L/yr.)	-	-	-	-	-	-	-	-	-
	Water (L/yr.)	-	-	-	-	-	-	-	-	-
Interactive Effects (Inputs)	Heating Penalty	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Cooling Benefits	0%	0%	0%	0%	0%	0%	0%	0%	0%
Interactive Effects (Results)	Electricity, Heating (kWh/yr.)	-	-	-	-	-	-	-	-	-
	Electricity, Cooling (kWh/yr.)	-	-	-	-	-	-	-	-	-
	Electricity, Total (kWh/yr.)	-	-	-	-	-	-	-	-	-
	Natural Gas (MJ/yr.)	-	-	-	-	-	-	-	-	-
	Oil (L/yr.)	-	-	-	-	-	-	-	-	-
Winter Peak Hours-Use Factor		-	-	-	-	-	-	-	-	-

Resource Savings	Electricity (kWh/yr.)	-	-	-	-	-	-	-	-	-
	Electricity (kW peak)	-	-	-	-	-	-	-	-	-
	Natural Gas (MJ/yr.)	6,458	6,458	6,458	3,927	3,927	3,927	3,847	3,847	5,958
	Oil (L/yr.)	-	-	-	-	-	-	-	-	-
	Water (L/yr.)	-	-	-	-	-	-	-	-	-
Cost Parameters	Upgrade, Material ($)	$150.00	$150.00	$150.00	$150.00	$150.00	$150.00	$150.00	$150.00	$150.00
	Upgrade, Installation ($)	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
	Baseline, Material ($)	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
	Baseline, Installation ($)	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
	Total Measure Cost ($)	$150.00	$150.00	$150.00	$150.00	$150.00	$150.00	$150.00	$150.00	$150.00
	Basis (Full/Incremental)	Incr.	Incr.	Incr.	Incr.	Incr.	Incr.	Incr.	Incr.	Incr.
Incremental O&M ($/yr.)		$0	$0	$0	$0	$0	$0	$0	$0	$0
Lifetimes	Upgrade (yrs.)	15	15	15	15	15	15	15	15	15
	Baseline (yrs.)	15	15	15	15	15	15	15	15	15
Cost Savings ($/yr.)		$63	$63	$63	$38	$38	$38	$38	$38	$58
Simple Payback (yrs.)		2.4	2.4	2.4	3.9	3.9	3.9	4.0	4.0	2.67
NPV of O&M Costs ($)		$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Benefits ($)	Electric Energy	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Electric Demand	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Natural Gas	$596	$596	$596	$362	$362	$362	$355	$355	$550
	Oil	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Water	$0	$0	$0	$0	$0	$0	$0	$0	$0
Measure TRC ($)		$446	$446	$446	$212	$212	$212	$205	$205	$400
Benefit/Cost Ratio		3.97	3.97	3.97	2.42	2.42	2.42	2.37	2.37	3.67

Heating: Shell Measures

Attic Insulation

Insulation levels can be increased in attics by blowing insulation into the attic spaces to fill and cover the space within the roof frame. One technique is to make sure loose-fill or batt insulation fills the attic floor joists fully and then add an additional layer of unfaced fibreglass batt insulation across the joists. To reduce cost, it is also possible to blow in cellulose insulation on top of the existing insulation instead.

Wall Insulation

It can be challenging to retrofit wall insulation in existing homes since the inside surfaces of the exterior walls are already finished. It is sometimes possible to add insulation to a wall by blowing insulating materials into the wall cavity, if sufficient space exists. Alternatively, if the siding is old and due for replacement, rigid foam insulation can be added before the new siding is installed. In this situation, it would also be quite cost effective to install a more effective vapour and air barrier (e.g., Dupont Tyvek®) to reduce the amount of air leakage through the walls.

Slab Insulation (Unfinished Basements)

Insulation can be added both under and on top of basement slab floors. However, in existing homes, only the latter is practical. It is assumed that additional insulation is added to the slab floor while the basement is being finished. This can be done by purchasing insulated sub floor panels or laying down extruded polystyrene rigid foam insulation.

Basement (Foundation) Insulation

In many homes, the basement is often under-insulated or even left uninsulated. Increasing the insulation level in basements can be achieved in a number of ways, including constructing a new insulated frame wall, moving the existing frame wall to increase the insulation level, adding extra insulation to the existing frame wall, adding rigid board insulation to the exterior of the foundation, or using a combination of interior and exterior rigid board insulation. As a lower cost alternative, it is also possible to use polyurethane foam.

Crawlspace Insulation

Insulation levels remain below code in many homes that include crawlspaces as part of the basement design. If the floor is exposed, it would first be necessary to install a vapour barrier (e.g., 6 mil (600 gauge/0.15 mm) polyurethane barrier). Polyurethane foam could then be applied to the ceiling of the crawlspace (or the outer walls if there are pipes running below the floor). In addition to increasing the insulation of the crawlspace, this would help to eliminate any air leaks. Co-benefits of improved crawlspace insulation include improved thermal comfort, fewer drafts, and less condensation.

Professional Air Sealing/Weather Stripping/Caulking

Air leakage sealing of building envelopes includes completion of a blower door test to quantify leakage levels and to identify the location of air leaks. Generally, major leakage occurs at window-to-wall interfaces, around doors (especially patio doors), through electrical and plumbing penetrations and at the top of foundation walls. Installation of sealant and gaskets are generally accepted methods for reducing air leakage in buildings. Other sources of air leaks include pot lights, wall-to-floor interfaces (i.e., top and bottom of baseboards) and bathroom and kitchen exhaust piping.

Homeowner Air Sealing/Weather Stripping/Caulking

Homeowner air leakage sealing does not include a blower door test to quantify leakage levels and to identify the location of air leaks. Homeowners are likely to identify leakage primarily in more visible areas of the envelope, for example, the major leakage at window-to-wall interfaces, around doors (especially patio doors), through electrical and plumbing penetrations and perhaps at the top of foundation walls. Installation of weather stripping, sealant and gaskets are the most likely methods to be used. Less visible sources of air leaks such as pot lights, wall-to-floor interfaces (i.e., top and bottom of baseboards), bathroom and kitchen exhaust piping, and leaks from the top of walls into the attic are less likely to be addressed by the homeowner.

Air Leakage Sealing and Insulation (Old Homes)

This measure is targeted at homes that are at least 30 years old, since many of these homes haven't had any work done to improve insulation and air-sealing deficiencies and it is generally most cost effective to upgrade the insulation and the air sealing at the same time. This includes wall, attic, foundation, and crawlspace retrofits of older homes but, for the purposes of this analysis, it is assumed that a retrofit is being conducted on the attic.

The air-sealing portion of the work could be accomplished by segmenting the attic. In each segment, the existing insulation could be moved to one side and polyurethane foam could be sprayed in (serves as an air sealant in addition to its insulating properties). It may also be necessary to install or refurbish top plates to prevent airflow into the attic through exterior wall cavities. Other considerations that would increase the cost of the air-sealing portion of the work and may be present in some homes include sealing pot lights and kitchen or bathroom exhaust piping. When completed, these measures would dramatically improve the air tightness of an older home. The attic insulation could subsequently be cost effectively improved with cellulose insulation.

Zoned-Up Windows: (ENERGY STAR®) Rating for a Colder Zone

High-performance windows incorporate a number of additional energy-saving features, including low-E (soft coating), insulating spacers, argon fill and low conductivity frames (which can be sliders, hinged or picture). These windows are certified based on their energy rating (ER), which is based on their tested energy performance rather than on their specific combination of features. In this case, however, the ENERGY STAR® windows for a colder zone are specified instead of the ENERGY STAR® windows for the zone where the house is located, e.g., Zone C ENERGY STAR® windows would be chosen for a house in Zone A. High-performance windows also provide occupant co-benefits, such as reduced interior noise, reduced air leakage, greater thermal comfort, and fewer condensation problems.

Super High-Performance Windows

In addition to low-E coating, argon fill and insulating spacers, super high-performance windows incorporate features such as triple glazing, transparent insulating films, and fibreglass frames.

Heating: Shell Measures (New Homes)

High-Performance Homes (EGH 80/R2000/ENERGY STAR®)

There are several certification schemes for energy-efficient new homes that incorporate integrated design and multiple envelope measures. An EnerGuide for Houses (EGH) rating is a standard measure of a home's energy performance, calculated by a professional EGH advisor. The rating is based on information on the construction of the home and the results of a blower door test performed once the house has been built.

The R-2000 standard is one method of achieving an EGH 80 rating. However, R-2000 homes are required to achieve an air tightness level of 1.5 ACH@50Pa, install a heat recovery ventilator (HRV), and meet other environmental requirements. This substantially increases the cost of the measure. The ENERGY STAR® for New Homes program has similar requirements and also requires that homes be rated EGH 80. Since these three high-performance home standards all result in essentially the same energy performance, the costs assumed for the measure are those of the least expensive of the three. EGH 80 is the lowest cost, since it allows the builder the most flexibility for achieving the energy performance.

Net-Zero Ready Energy Homes

Net-zero energy homes (NZEH) produce at least as much energy as they consume. This is accomplished by incorporating on-site power generation, such as solar PV panels or small wind turbines, to offset electrical loads. However, the energy consumption of a NZEH is significantly lower, due to the addition of a wide array of energy-efficiency features. Measures that are typically considered include increased insulation, super high-performance windows, ENERGY STAR® appliances, solar thermal space and/or water heating, heat pumps, and passive solar designs. This measure is designed to produce a highly efficient house that is ready to be turned into a NZEH with the addition of on-site renewable energy generation.

Heating: Equipment

High-efficiency Condensing Gas Furnaces

Federal legislation now requires that all residential furnaces meet the minimum performance standard of 90% AFUE. However, higher efficiency condensing furnaces are available. These furnaces include more advanced heat exchanger designs that extract more heat from the flue gases before they are exhausted.

Early Retirement of Existing Gas Furnaces

Federal legislation now requires that all residential furnaces meet the minimum performance standard of 90% AFUE. However, consumers with less efficient furnaces that still work may wait years before replacing them. Early retirement of existing furnaces that are still functional is an option. Energy savings only last until the old furnace would have been replaced; after that, the energy consumption of the base case and upgrade is the same. The consumer has the added peace of mind of having a new furnace that is less likely to break down in winter.

Condensing Gas Boilers

High-efficiency condensing boilers feature advanced heat exchanger designs that extract more heat from the flue gases before they are exhausted. So much heat is extracted that the flue gases condense and must be discharged as a condensate rather than a gas. In retrofit applications where condensing boilers are replacing non-condensing units, it may be necessary to modify the radiating system. Otherwise, the units may not actually condense the flue gas and realize their full efficiency potential.

High-efficiency Gas Fireplaces

All vented gas fireplaces sold in Canada must now be tested for their energy efficiency using the Canadian Standards Association CSA-P.4.1-02 standard if they are shipped across provincial lines. The energy-efficiency rating of the fireplace is printed on the EnerGuide label. EnerGuide does not set a minimum efficiency level, so savings are possible by using the EnerGuide label to choose the most efficient unit.

Programmable Thermostats (Central Heating and Cooling)

Digital programmable thermostats provide improved temperature setting accuracy and allow occupants to preset temperatures for various time periods. A 4°C temperature setback is often assumed during night and unoccupied periods. However, utility studies have indicated that a lower average setback value should be used to reflect the fact that the thermostat's setback capabilities do not completely reflect how they are used. For example, some home occupants reliably set back manual thermostats while others do not use the setback features on their electronic thermostats.

Solar Pre-Heated Make-Up Air Systems (e.g., SolarWall®)

Solar pre-heated ventilation systems pre-heat incoming ventilation air and reduce heat loss through the portion of the building shell covered by them. They consist of perforated steel or aluminum absorber sheets that are mounted vertically on a building's exterior surface and are ideally mounted on southerly facing walls, plus or minus 20 degrees. The dark coloured metal sheets that make up the system are mounted a small distance away from the building's surface, creating an air cavity. A negative pressure is created within the cavity by ventilation fans and air is drawn through small holes in the metal panels.

On sunny winter days, these systems can raise incoming air temperatures by 25°C to 35°C. In summer months, ventilation air can be drawn directly from the outside through a bypass damper, while heated air is rejected through vents at the top of the air cavity. These systems are generally used in commercial and industrial applications but they have seen some limited residential use.

High-efficiency Heat Recovery Ventilators (HRVs)

Heat recovery ventilators (HRVs) are heat exchangers that are integrated into the centralized ventilation and exhaust systems of many newer homes. In the winter, they allow for incoming fresh air to be heated by outgoing stale air. Conversely, in homes with central air conditioning systems, they allow incoming fresh air to be cooled by outgoing stale air in the summer. High-efficiency HRVs incorporate more effective heat exchangers. Some models also include desiccant wheels so that latent heat (i.e., humidity) can be transferred between the two air streams.

Gas-Fired Air-Source Heat Pumps

Early gas-fired heat pumps, such as the York Triathlon, were unsuccessful due to their bulky size and poor quality design. A new generation of gas absorption heat pumps (GAHPs) is currently available through Robur, an Italian manufacturer. These systems can either be ground-source or air-source (i.e., the heat sink may be either an underground fluid loop or an above ground heat exchanger coil). Air-source systems are substantially less expensive since they don't require drilling to install underground fluid loops. However, they can also be much less efficient than ground-source versions since their efficiency is a function of outside air temperature.

Commercial-sized GAHP systems have been available in Canada since mid-2007 but residential-sized systems are rare in North America. It is hoped that residential-sized units will become more available in Canada within the study period, but the current manufacturers do not have specific plans at this time. It is estimated that air-source systems can operate at temperatures as low as -29°C and have annual efficiencies of 105% in cold winter locations. In more moderate winter climates, an efficiency of up to 129% is advertised.

Unlike electric heat pump systems, GAHPs do not require any auxiliary heating equipment. In addition, the lack of a mechanical compressor extends their lifetime and allows air-source systems to withstand more extreme temperatures.

Gas-Fired Ground-Source Heat Pumps

Early gas-fired heat pumps, such as the York Triathlon, were unsuccessful due to their bulky size and poor quality design. A new generation of gas absorption heat pumps (GAHPs) is currently available through Robur, an Italian manufacturer. These systems can either be ground-source or air-source (i.e., the heat sink may be either an underground fluid loop or an above ground heat exchanger coil). Air-source systems are substantially less expensive since they don't require drilling to install underground fluid loops. However, they can also be much less efficient than ground-source versions since their efficiency is a function of outside air temperature.

Commercial-sized GAHP systems have been available in Canada since mid-2007 but residential-sized systems are not currently available outside of Europe. It is hoped that residential-sized units will become more available in Canada within the study period, but the current manufacturers do not have specific plans at this time. Ground-source GAHPs have efficiencies (COPs) ranging from 120% to 130%.

Unlike electric heat pump systems, GAHPs do not require any auxiliary heating equipment. In addition, the lack of a mechanical compressor extends their lifetime.

Integrated Heating and DHW (Forced Air Heating)

Integrated mechanical systems combine the most efficient technologies for residential space heating and domestic water heating into one package. For example, the Matrix system by NTI NY Thermal incorporates a condensing furnace, condensing boiler, condensing water heater and HRV all in one unit. Primary benefits of the integrated units include compact construction, lower cost of installation (only one set of gas, water and circulation connections are required), and lower installation and maintenance costs (once the technology is mature).

Since the minimum performance standards for furnaces was brought up to 90% efficiency at the end of 2009, the base case system is a 90% efficient forced-air furnace and a standard efficiency natural gas tank-style water heater. With this baseline, the integrated system would offer little in the way of space heating savings, but it does still offer DHW savings because the integrated system would heat domestic water with its high-efficiency, condensing combustion.

Integrated Heating and DHW (Hydronic Heating)

Integrated mechanical systems combine the most efficient technologies for residential space heating and domestic water heating into one package. For example, the Matrix system by NTI NY Thermal incorporates a condensing furnace, condensing boiler, condensing water heater and HRV all in one unit. Primary benefits of the integrated units include compact construction, lower cost of installation (only one set of gas, water and circulation connections are required), and lower installation and maintenance costs (once the technology is mature).

Water heating in the base case is assumed to be provided by a standard efficiency natural gas tank-style water heater (EF of 0.62 or 0.64), while space heating is provided by a non-condensing boiler, assumed to have an AFUE of 82%. The HRV in the base case is assumed to be of similar efficiency to the HRV in the integrated unit.

Water Heating

Condensing Gas Water Heaters

Condensing water heaters feature advanced heat exchanger designs that extract more heat from the flue gases before they are exhausted. So much heat is extracted that the flue gases condense and must be discharged as a condensate rather than a gas. As a result, the efficiency of these types of water heaters is significantly higher than standard water heaters.

Point-of-Use (Tankless) Water Heaters (Gas)

Tankless water heaters heat water on demand, eliminating hot water storage. The absence of hot water storage reduces standby heat losses. The efficiency of tankless water heaters is generally improved by the addition of features such as modulating controls, electric spark ignitions and direct venting. The applicability of tankless gas-fired DHW systems is somewhat limited by venting constraints; the burner is significantly larger than for a standard water heater, so a larger vent is required. Some houses cannot accommodate the larger flue because of requirements for clearance from other structures, windows, etc.

Active Solar Water Heating Systems

Solar DHW systems use the energy of the sun to heat water. The primary components of a solar water heating system are a solar collector, a heat transfer fluid and a well-insulated storage tank. Due to Canada's colder climate and the higher likelihood of freezing, active closed-loop systems are generally used. These systems use a pump to circulate a non-freezing heat transfer fluid through the collectors and then through a heat exchanger so that the thermal energy can be transferred to the water.

Solar DHW are not generally sized to supply all of the annual requirement for water heating in the home, because if the system is sized for cloudy winter periods it will have enormous excess capacity during sunny summer periods, and will cost far too much to install. The system analyzed here meets approximately two-thirds of the annual requirements.

DHW Tank Insulation

Pre-cut tank jackets/blankets (DHW tank insulation) are readily available and can be installed on hot water storage tanks to reduce standby heat losses. Caution is required to install blankets on gas water heaters, to avoid blocking the flue, the air intake to the burner, or the drain at the bottom. The thermostat should also remain uncovered.

DHW Pipe Insulation

Hot water pipe insulation reduces the distribution losses for DHW. In general, only the first one or two metres of pipe nearest the DHW tank are accessible enough to insulate. However, since the dominant loss is from the pipe transferring heat out of the tank and then losing it to the basement, the first meter of pipe is the most important and only worthwhile section of pipe to insulate. Insulating this section of piping affects both the delivery of hot water and the losses from the tank. Delivery temperature is slightly increased during a hot water draw, and the water in the piping does not lose its stored heat as quickly between draws.

DHW Heat Traps

This measure involves the installation of external "S-type" pre-bent copper pipe heat traps on both of the outlets of water heaters. This measure is only being considered during the installation of new tanks since it can be prohibitively expensive to bring in a plumber otherwise.

Ultra Low-Flow Showerheads

Ultra low-flow showerheads have aerators and flow restrictors to reduce water use. At 4.75 LPM (1.25 GPM), their flow rates are substantially lower than traditional low-flow fixtures, whose flow rates range between 7.6 LPM and 9.5 LPM (2.0-2.5 GPM).

Faucet Aerators

Aerators can easily be attached to most faucets to restrict the flow rate of water flowing from them. This can result in savings to both water consumption and DHW energy.

Wastewater Heat Recovery Systems

Residential wastewater heat recovery systems transfer the waste heat from drains to pre-heat make-up water. These systems work well only for DHW uses in which the hot water use and the draining of wastewater are simultaneous. Thus, in homes, application to anything other than showers is difficult. Heat recovery systems incorporate shell-and-tube heat exchangers that typically have efficiencies in the range of 40% to 55%, depending on factors such as design, material, overall length, and fluid flow rate.

DHW Recirculation Systems (e.g. Metlund D'MAND®)

When turning on the hot water tap, it often takes a long time before hot water begins to flow. DHW recirculation systems can be used to pump hot water to a faucet at the demand of a user, getting hot water to the fixture four to five times quicker than traditional systems. Water that is in the hot water lines is pumped back to the water heater either through the cold water lines or through a dedicated line. This pumping continues until the temperature of the hot water at the point of use reaches a specified value. In retrofit situations, this pumping system is generally installed at the faucet that is furthest away from the water heater and the system is enabled by remote activation from the other points of use.

Along with improved convenience and water savings (since water isn't flushed down the drain), energy savings are achieved since the water that is pumped back to the water heater is generally warmer than city water. In addition, since the pump gets water to the fixture more quickly, there is an overall reduction of hot water use.

Appliances

High-Efficiency (ENERGY STAR®) Dishwashers

ENERGY STAR® dishwashers save energy by using improved technology for the primary wash cycle and by using less hot water to clean. Features include more effective washing action, energy-efficient motors, and sensors that determine the length of the wash cycle and the temperature of the water necessary to clean the dishes. In addition, some advanced dishwashers can sense and adjust for the amount of soil on dishes, using only as much water as necessary. These savings affect both the energy used for heating the water and the mechanical energy of the dishwasher.

High-Efficiency (ENERGY STAR®) Clothes Washers

In January 2011, the ENERGY STAR® standard for clothes washers will be increased once again. As a result, very few top loading washers will meet ENERGY STAR® requirements. Instead, the overwhelming majority of ENERGY STAR® models will be front loading (horizontal axis) models. Compared to standard models, front-loading washing machines use less hot water, less mechanical energy, and result in dryer energy savings due to faster spin cycle speeds.

High-Efficiency Gas Clothes Dryers

The major distinction with energy-efficient gas clothes dryer models is that they incorporate termination controls to sense dryness and turn off automatically. The most efficient models have moisture sensors in the drum for sensing dryness, while other lower cost and slightly less efficient models infer dryness by sensing the temperature of the exhaust air. The majority of the retail models currently available employ some type of dryness sensing technology but it is unclear how often homeowners use these controls.

Other

Insulating Pool Covers

Between 30% and 50% of the heat loss from a swimming pool is due to evaporation. In an outdoor pool, this heat loss either adds to the cost of heating the pool or shortens the swimming season. Evaporation also increases the quantity of chemicals that must be added to the pool. A pool cover can reduce evaporation and other heat losses but can also reduce heat gains depending on the design. An insulating vinyl pool cover is assumed for this analysis. Although substantially more expensive than the bubble type covers, insulating vinyl pool covers are much more robust and, thus, have much longer lifetimes. They are also more effective at trapping heat.

Heat Pump Pool Heaters

Air-source heat pumps can be used to replace electric or gas-fired pool heaters. The principal of operation for these types of heat pumps is very similar to refrigerators and air conditioning units in that they are used to transfer heat from one place to another. This allows them to be significantly more efficient than electric or gas-fired pool heaters since these types of heaters generate heat rather than transferring it.

High-Efficiency Gas-Fired Pool Heaters

High-efficiency pool heaters incorporate advanced heat exchangers, forced draft combustion systems, pilot-less ignitions and innovations in hydraulics, which result in performance efficiencies that range between 90% and 95%, compared to efficiencies of 80% to 85% for standard models.

Solar Pool Heaters

Unlike other types of solar hot water systems, solar pool heaters do not include storage tanks or heat exchangers and, since they are only used in warmer weather, they generally employ unglazed solar collectors that are composed of a polymer. These collectors are mounted on the roofs of homes or in an unshaded part of the yard. The heat transfer fluid is usually pool water that is pumped directly into the array of collectors and flows within the polymer in a serpentine array in order to pick up heat. Although solar DHW systems do require a pump, its consumption is similar to that used in electric and gas-fired pool heaters.

Solar pool heaters can completely offset the energy requirements of conventional pool heaters and, since they are much simpler than solar DHW systems, they are also much more affordable.

Micro-Combined Heat and Power (CHP)

Several types of micro-combustion heat and power (micro-CHP) systems are either available or under development. These units all generate electrical power and capture the resulting “waste” heat for space and/or water heating. Reciprocating engine units such as the Honda Freewatt use a well-developed technology and can be scaled to a residential size. Power generating efficiencies range from 20%-40% and up to 90% of the waste heat can be captured. Various sizing and control strategies can be used, e.g., the amount of heat can be maximized or the amount of electricity can be maximized. This example assumes a unit such as the Honda Freewatt hydronic system, which has a 1.2 kW maximum electrical output and a 3.5 kW thermal output. Heat load following control is assumed to avoid fuel switching, however power load following control is usually more economically attractive for applications involving seasonally varying loads. A back-up boiler is included in the Honda Freewatt package. Net metering is assumed.

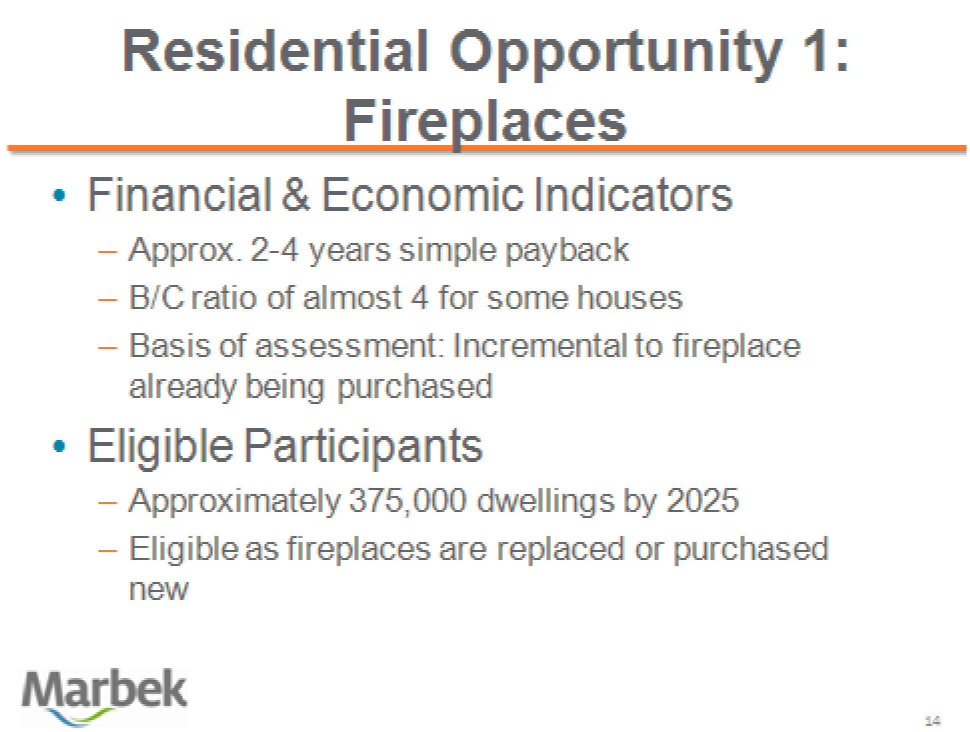
Appendix D

Background - Section 8: Achievable Workshop Action Profile Slides

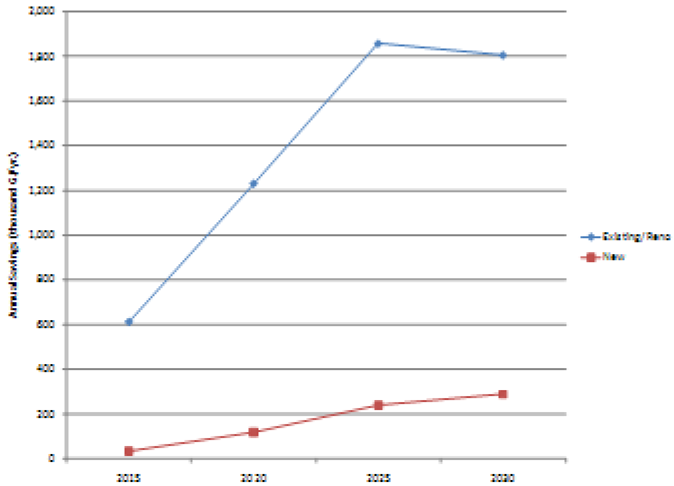
Introduction

Exhibit D1 through Exhibit D6 show the slides that were prepared before the Achievable Potential workshop to provide participants with background information on each of the measures discussed.

Exhibit D 1 Residential Action Profile Slides, Opportunity 1



Residential Opportunity 1: Fireplaces



Marbek

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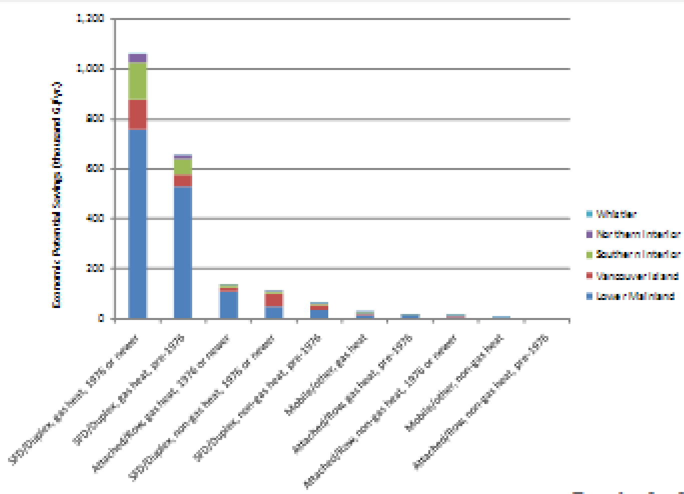
Residential Opportunity 1: Fireplaces



Results for 2030

Marbek

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Exhibit D 2 Residential Action Profile Slides, Opportunity 2

Residential Opportunity 2: Basement Insulation

- Technology Description
  - Measure involves adding basement insulation to an already-planned basement renovation project
- Discussion Dwelling Type: Pre-1976 single detached
- Typical Application
  - Cost: estimated at $1,400 installed
  - Useful life: 30 years
  - Savings: approx 12% of space heating energy

Marbek

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Residential Opportunity 2: Basement Insulation

- Financial & Economic Indicators
  - Approx. 14 years simple payback
  - B/C ratio = just over 1 for some house types and regions
  - Basis of assessment: Incremental to renovation project
- Eligible Participants
  - Approximately 110,000 dwellings by 2030
  - Eligible as basement renovations are planned

Marbek

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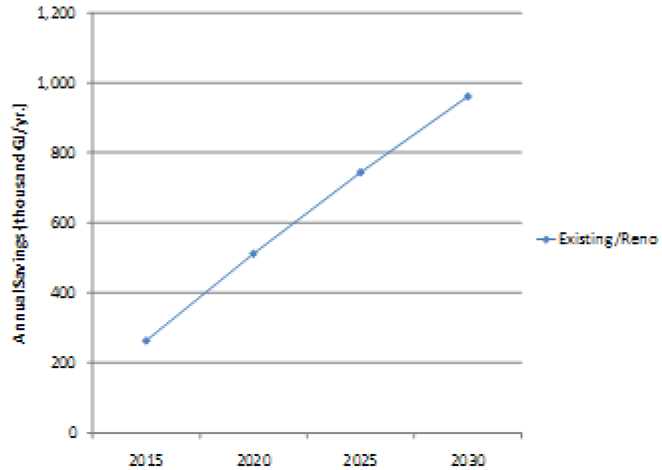
Residential Opportunity 2: Basement Insulation



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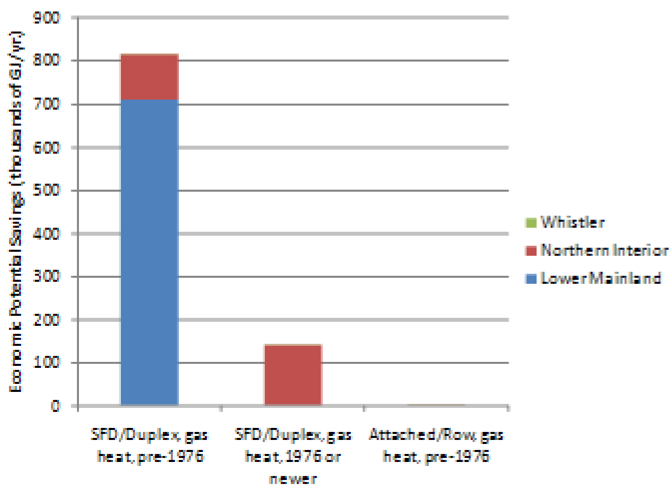
Residential Opportunity 2: Basement Insulation



Results for 2030

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Exhibit D 3 Residential Action Profile Slides, Opportunity 3

Residential Opportunity 3: Solar Pool Heaters

- Technology Description
  - Measure involves installing solar pool heaters, ideally instead of gas heaters (but could be as well)
- Discussion Dwelling Type: Existing single detached
- Typical Application
  - Cost: estimated at $3,450 full cost installed
  - Useful life: 20 years
  - Savings: can be 100% of pool heater energy

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Residential Opportunity 3: Solar Pool Heaters

- Financial & Economic Indicators
  - Approx. 9 years simple payback
  - B/C ratio of about 1.25
  - Basis of assessment: full cost
- Eligible Participants
  - Approximately 30,000 pools by 2030
  - Eligible immediately, with new pools done as they are installed

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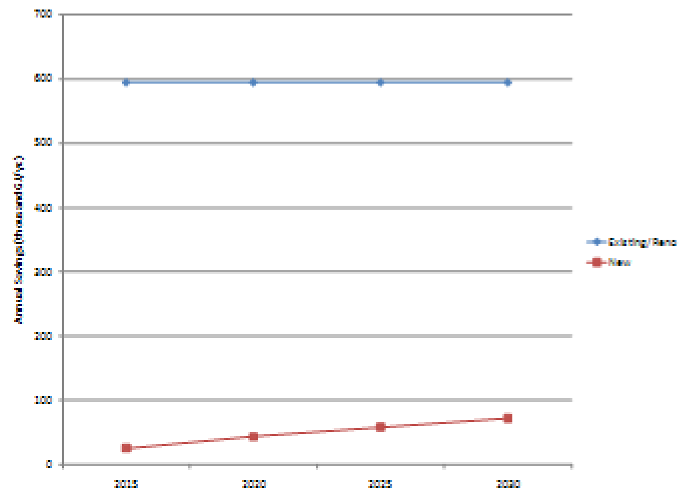
Residential Opportunity 3: Solar Pool Heaters



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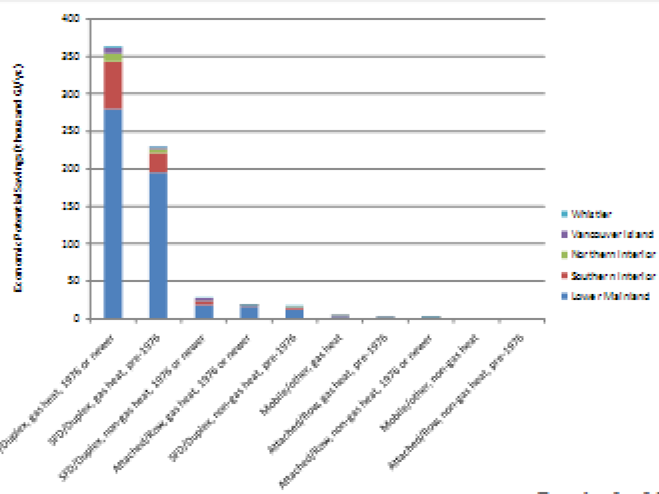
Residential Opportunity 3: Solar Pool Heaters



Results for 2030

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Exhibit D 4 Residential Action Profile Slides, Opportunity 4

Residential Opportunity 4: Ultra Low-flow Showerheads

- Technology Description
  - Measure involves installing ultra low-flow showerheads: 1.25 gpm (4.75 lpm)
- Discussion Dwelling Type: Existing single detached
- Typical Application
  - Cost: estimated at $13 full cost, installed by owner
  - Useful life: 10 years
  - Savings: 37.5% of shower, or nearly 10% of DHW

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Residential Opportunity 4: Ultra Low-flow Showerheads

- Financial & Economic Indicators
  - Less than 1 year simple payback
  - B/C ratio of about 10
  - Basis of assessment: full cost
- Eligible Participants
  - Over 400,000 households in 2015 (declining due to naturally-occurring installations)
  - Eligible immediately

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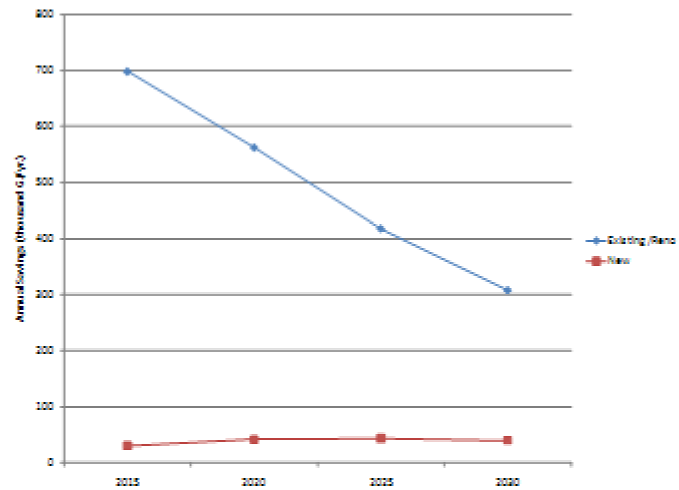
Residential Opportunity 4: Ultra Low-flow Showerheads



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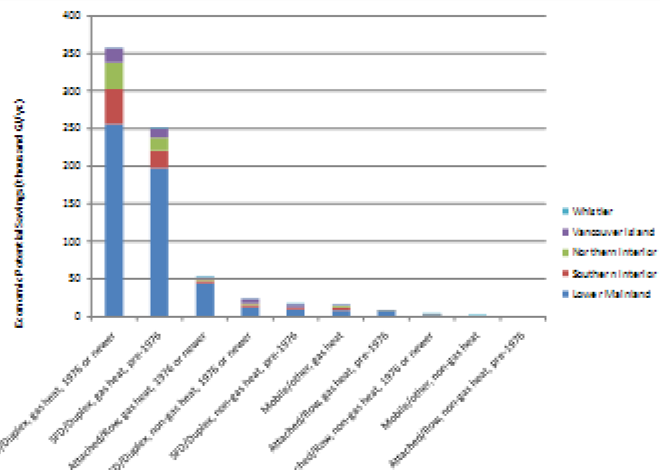
Residential Opportunity 4: Ultra Low-flow Showerheads



Results for 2015

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Exhibit D 5 Residential Action Profile Slides, Opportunity 5

Residential Opportunity 5: Furnace Early Retirement

- Technology Description
  - Measure involves replacing existing furnaces before end of life with new (90%) furnaces
  - Numbers are based on replacement at 9 years, halfway through life
  - Higher efficiency (96%) furnaces are a separate measure
- Discussion Dwelling Type: Existing single detached

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Residential Opportunity 5: Furnace Early Retirement

- Typical Application
  - Cost: estimated at $1,860 net of same cost discounted by 9 years
  - Useful life: 9 years (until normal replacement)
  - Savings: approx. 14% of space heating energy
- Financial & Economic Indicators
  - Payback is longer than the 9-year useful life
  - B/C ratio of about 0.3
  - Basis of assessment: incremental

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Residential Opportunity 5: Furnace Early Retirement

- Eligible Participants
  - Over 480,000 households in 2020 (declining due to naturally-occurring installations)
  - Eligible as furnaces exceed 9 years of age – do oldest ones first

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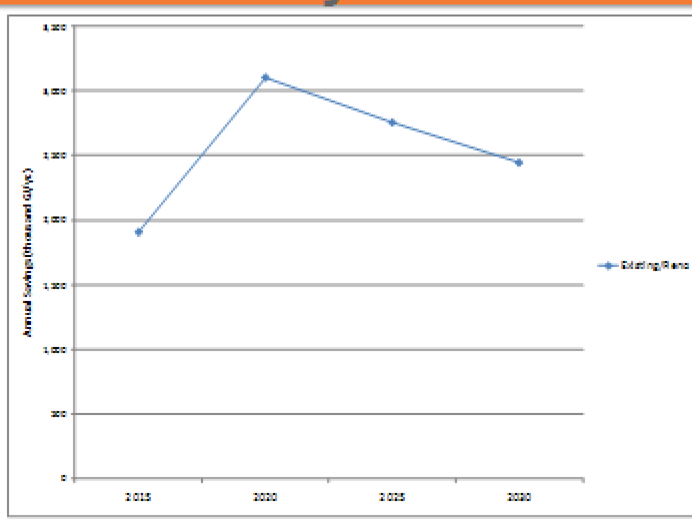
Residential Opportunity 5: Furnace Early Retirement



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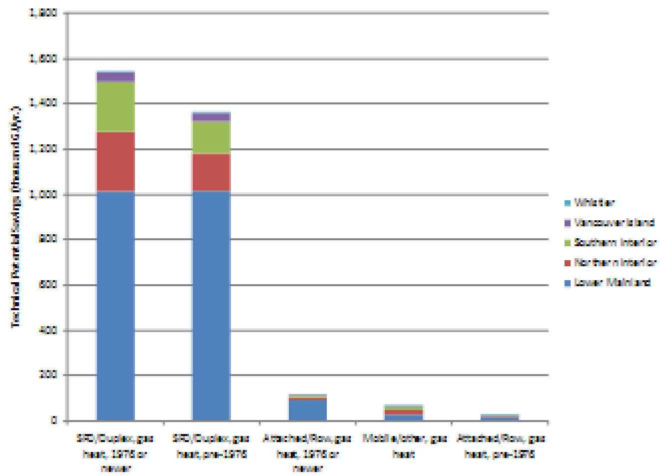
Residential Opportunity 5: Furnace Early Retirement



Results for 2020

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33

Exhibit D 6 Residential Action Profile Slides, Opportunity 6

Residential Opportunity 6: Attic Insulation

- Technology Description
  – Measure involves adding attic insulation to an existing house
- Discussion Dwelling Type: Pre-1976 single detached
- Typical Application
  – Cost: estimated at $675 installed in single detached
  – Useful life: 30 years
  – Savings: approx 6% of space heating energy

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Residential Opportunity 6: Attic Insulation

- Financial & Economic Indicators
  – Approx. 13 years simple payback
  – B/C ratio = just over 1 for some house types and regions
  – Basis of assessment: Full cost
- Eligible Participants
  – Approximately 100,000 dwellings
  – Eligible immediately

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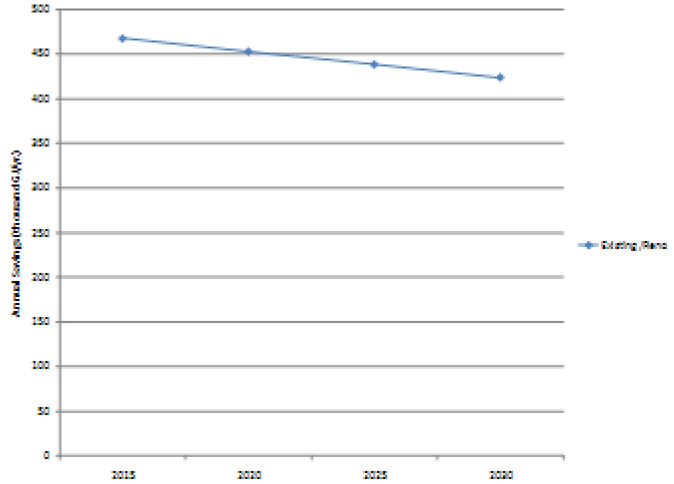
Residential Opportunity 6: Attic Insulation



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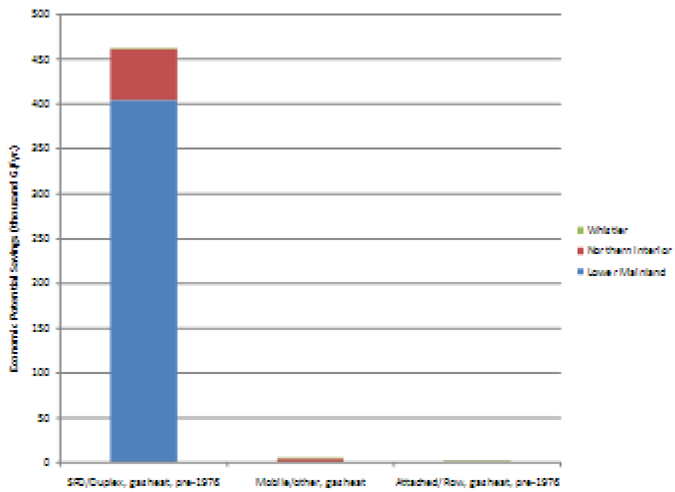
Residential Opportunity 6: Attic Insulation



Results for 2015

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Appendix E Background – Section 8: Achievable Workshop Measure Worksheets

Introduction

Exhibit E 1 through Exhibit E 6 show the worksheets that were prepared before the Achievable Potential workshop to provide a structured format in which to record the results of the discussions on each measure. The workshop results, as recorded during the discussions, are included in the exhibits.

Exhibit E 1 Residential Achievable Worksheet, Opportunity 1

FORTISBC - ACHIEVABLE POTENTIAL WORKSHOP - RESIDENTIAL SECTOR

R1: High-Efficiency Fireplaces

	LM		COMMENTS
	All LM Dwellings		
	2015/Curve	2025	
MEASURE INFORMATION			
Benefit/Cost Ratio	4.0		
Simple Payback (years)	3.0		
ECONOMIC POTENTIAL (thousands of dwellings)			
Total Number of Dwellings	545	574	
Dwellings Affected (Cumulative)	75	240	
Dwellings Affected (Per Year)	15	17	Estimate of 5k/yr being replaced currently.
PARTICIPATION RATES (%)			
"Common Sense" scenario		29%	Curve B
Aggressive Marketing		59%	Curve B: Time for design, consumer education
ACHIEVABLE POTENTIAL (thousands of dwellings)			
BAU Marketing		71	
Aggressive Marketing		141	
PARTICIPATION RATES (relative to discussion scenario)			
Vancouver Island Service Territory		S	
Southern Interior Service Territory		S	
Northern Interior Service Territory			
Whistler Service Territory			
Attached Homes		Lower (-10%)	Many not replacing upon failure. May req approval from strata.
New Homes		Higher	
OTHER PARAMETERS			
Sensitivity to Incentives (High, Medium, Low)			
Primary Incentive Target (User, Channel Member, Both)			User/Channel
Sensitivity to Direct Program Support (High, Medium, Low)			
Most Critical Program Support Type(s) (e.g. Trade Ally Training, Certification, Technical Workshops, etc.)			Training, education

Exhibit E 2 Residential Achievable Worksheet, Opportunity 2

FORTISBC - ACHIEVABLE POTENTIAL WORKSHOP - RESIDENTIAL SECTOR

R2: Basement Insulation

	LM		COMMENTS
	Single Detached, Existing		
	2015/Curve	2030	
MEASURE INFORMATION			
Benefit/Cost Ratio	1.0		
Simple Payback (years)	14.0		
ECONOMIC POTENTIAL (thousands of dwellings)			
Total Number of Dwellings	545	586	
Dwellings Affected (Cumulative)	24	88	
Dwellings Affected (Per Year)	5	4	
PARTICIPATION RATES (%)			
"Common Sense" scenario		38%	Curve A.
Aggressive Marketing		75%	Curve:A . No supply constraints,
ACHIEVABLE POTENTIAL (thousands of dwellings)			
"Common Sense" scenario		33	
Aggressive Marketing		66	
PARTICIPATION RATES (relative to discussion scenario)			
Vancouver Island Service Territory		S	
Southern Interior Service Territory		S	
Northern Interior Service Territory		S	
Whistler Service Territory		S	
Attached Homes		S	
New Homes		S	
OTHER PARAMETERS			
Sensitivity to Incentives (High, Medium, Low)			
Primary Incentive Target (User, Channel Member, Both)			
Sensitivity to Direct Program Support (High, Medium, Low)			
Most Critical Program Support Type(s) (e.g. Trade Ally Training, Certification, Technical Workshops, etc.)			

Exhibit E 3 Residential Achievable Worksheet, Opportunity 3

FORTISBC - ACHIEVABLE POTENTIAL WORKSHOP - RESIDENTIAL SECTOR

R3: Solar Pool Heaters

	LM		COMMENTS
	All LM Pools		
	2015/Curve	2030	
MEASURE INFORMATION			
Benefit/Cost Ratio	1.3		
Simple Payback (years)	9.0		
ECONOMIC POTENTIAL (thousands of dwellings)			
Total Number of Dwellings	545	586	
Dwellings Affected (Cumulative)	25	26	
Dwellings Affected (Per Year)	5	0	
PARTICIPATION RATES (%)			
"Common Sense" scenario		30%	Curve B.
Aggressive Marketing		55%	Curve: B. Simple, but requires education for uptake
ACHIEVABLE POTENTIAL (thousands of dwellings)			
"Common Sense" scenario		8	
Aggressive Marketing		15	
PARTICIPATION RATES (relative to discussion scenario)			
Vancouver Island Service Territory		S	Maybe some difference b/c of solar irradiation
Southern Interior Service Territory		slightly higher	
Northern Interior Service Territory		S	
Whistler Service Territory		S	
Attached Homes		Higher	less concern for cosmetics, shared cost.
New Homes		S	
OTHER PARAMETERS			
Sensitivity to Incentives (High, Medium, Low)			
Primary Incentive Target (User, Channel Member, Both)			
Sensitivity to Direct Program Support (High, Medium, Low)			
Most Critical Program Support Type(s) (e.g. Trade Ally Training, Certification, Technical Workshops, etc.)			

Exhibit E 4 Residential Achievable Worksheet, Opportunity 4

FORTISBC - ACHIEVABLE POTENTIAL WORKSHOP - RESIDENTIAL SECTOR

R4: Ultra Low-Flow Showerheads

	LM		COMMENTS
	All LM Dwellings		
	2015/Curve	2030	
MEASURE INFORMATION			
Benefit/Cost Ratio	10.0		
Simple Payback (years)	<1		
ECONOMIC POTENTIAL (thousands of dwellings)			
Total Number of Dwellings	545	586	
Dwellings Affected (Cumulative)	283	134	Declines because of natural conservation
Dwellings Affected (Per Year)	57	7	*review natural conservation assumption.
PARTICIPATION RATES (%)			
"Common Sense" scenario		10%	Curve C
Aggressive Marketing		16%	Curve C
ACHIEVABLE POTENTIAL (thousands of dwellings)			
"Common Sense" scenario		13	
Aggressive Marketing		21	
PARTICIPATION RATES (relative to discussion scenario)			
Vancouver Island Service Territory		Higher (50%)	more push for water efficiency, metered water
Southern Interior Service Territory		Higher (50%)	more push for water efficiency, metered water
Northern Interior Service Territory			
Whistler Service Territory			
Attached Homes			
Existing Homes			
OTHER PARAMETERS			
Sensitivity to Incentives (High, Medium, Low)			
Primary Incentive Target (User, Channel Member, Both)			
Sensitivity to Direct Program Support (High, Medium, Low)			
Most Critical Program Support Type(s) (e.g. Trade Ally Training, Certification, Technical Workshops, etc.)			

Exhibit E 5 Residential Achievable Worksheet, Opportunity 5

FORTISBC - ACHIEVABLE POTENTIAL WORKSHOP - RESIDENTIAL SECTOR

R5: Furnace Early Retirement

	LM		COMMENTS
	Single Detached, Existing		
	2020/Curve	2030	
MEASURE INFORMATION			
Benefit/Cost Ratio	0.3		
Simple Payback (years)	> measure life		
ECONOMIC POTENTIAL (thousands of dwellings)			
Total Number of Dwellings	561	586	
Dwellings Affected (Cumulative)	329	256	Declines because of natural conservation
Dwellings Affected (Per Year)	33	13	
PARTICIPATION RATES (%)			
"Common Sense" scenario		50%	Curve A
Aggressive Marketing		75%	Curve C
ACHIEVABLE POTENTIAL (thousands of dwellings)			
"Common Sense" scenario		128	
Aggressive Marketing		192	
PARTICIPATION RATES (relative to discussion scenario)			
Vancouver Island Service Territory		Lower	few old furnaces
Southern Interior Service Territory		S	
Northern Interior Service Territory		S	
Whistler Service Territory		S	
Attached Homes		S	
New Homes		n/a	
OTHER PARAMETERS			
Sensitivity to Incentives (High, Medium, Low)			
Primary Incentive Target (User, Channel Member, Both)			
Sensitivity to Direct Program Support (High, Medium, Low)			
Most Critical Program Support Type(s) (e.g. Trade Ally Training, Certification, Technical Workshops, etc.)			

Exhibit E 6 Residential Achievable Worksheet, Opportunity 5

FORTISBC - ACHIEVABLE POTENTIAL WORKSHOP - RESIDENTIAL SECTOR

R6: Attic Insulation

	LM		COMMENTS
	Single Detached, Existing		
	2015/Curve	2030	
MEASURE INFORMATION			
Benefit/Cost Ratio	1.1		
Simple Payback (years)	13.0		
ECONOMIC POTENTIAL (thousands of dwellings)			
Total Number of Dwellings	545	586	
Dwellings Affected (Cumulative)	99	89	
Dwellings Affected (Per Year)	20	4	
PARTICIPATION RATES (%)			
"Common Sense" scenario			
Aggressive Marketing			
ACHIEVABLE POTENTIAL (thousands of dwellings)			
"Common Sense" scenario		0	
Aggressive Marketing		0	
PARTICIPATION RATES (relative to discussion scenario)			
Vancouver Island Service Territory			
Southern Interior Service Territory			
Northern Interior Service Territory			
Whistler Service Territory			
Attached Homes			
New Homes			
OTHER PARAMETERS			
Sensitivity to Incentives (High, Medium, Low)			
Primary Incentive Target (User, Channel Member, Both)			
Sensitivity to Direct Program Support (High, Medium, Low)			
Most Critical Program Support Type(s) (e.g. Trade Ally Training, Certification, Technical Workshops, etc.)			

Appendix F **Background – Section 8: Achievable Workshop Discussion Summaries**

Introduction

Appendix F provides a summary of the discussions on each of the actions discussed during the Achievable Potential workshop.

Action R1 – Gas Fireplaces

- Non-energy/design factors drive consumer demand more than energy efficiency. Style requirements are usually paramount.
- Bulk of sales are "zero clearance" models, where geometry is very similar, restricting upgrade options.
- Most pre-1990 fireplaces are more difficult to replace, as there may be restrictions on venting, etc.
- Is there a portion that may switch their fireplaces to electric? Probably, mostly in apartment buildings.
- Many fireplaces are essentially decorative. Efficiency can be between 0%-40%.
- Note that fireplaces are "localized," zoned heat, which is an inherently more efficient way to use heat (analogous to task lighting).
- Only a few manufacturers are making an 80% efficient fireplace. Typically there are no retrofit challenges, but would require replacement of venting.
- Baseline of 60% efficiency is probably too high (80% for the upgrade is probably too high as well). Overall savings are likely realistic (maybe 50%-70%, 55%-75%). Installed base is likely around 40% on average.
- Challenges to selling energy-efficient fireplaces: People say efficiency is important, but it may not be as high in reality.
- Most decisions made at dealership level. Dealer can influence decision. FortisBC has incentivized dealers/salespeople in the past. Joint incentive (dealer/customer) may be an appropriate approach.
- This may be attractive when included in a complete renovation.
- Research shows that ENERGY STAR® is driving purchase decisions for many products. There is an EnerChoice rating for fireplaces (64%, 62% for inserts). Barrier: Lack of customer recognition of EnerChoice.
- May be attractive to roll into LiveSmart program.
- Gas permit generally required for fireplace retrofit.
- Federal tax credit did move the market in the recent past.
- Other energy-efficiency features: pilot on/off, programmed pilot system (i.e., if fireplace has not been used in five days, the pilot light shuts itself off automatically).

- Permitting authority may be a contact point for delivery of educational materials, etc.

Action R2 – Basement Insulation

- Generally requires an energy audit: difficult to get uptake on audit at outset. No strong relationship with trade allies.
- LiveSmart has been incentivizing these sorts of retrofits. Incentives are currently quite modest, especially without NRCan incentive (making it a tough sell for the installers).
- Long payback a barrier for those not planning on remaining in the same house over the long term. Does not increase resale value of the home commensurately with the expense.
- Opportunity to sell non-energy benefits. Those looking only at payback are tougher sell. About 80% of customers in the "what's in it for me" group.
- Lower Mainland market - a driver is the installation of basement apartments.
- Adding EnerGuide rating to MLS listing could be a driver.
- Barrier: big ticket items viewed as capital investment.
- Simplifying/educating is important.
- Potential partners: BC Hydro, installers, realtors. Recent research indicates rated homes sell faster.
- Some pushback from MLS (fear that low-end homes will be more difficult to sell).
- Important for trades to "cross sell": insulation/windows/etc.
- Possible delivery channels: building supply stores, contractors, possibly realtors.

Action R3 – Solar Pool Heaters

- FortisBC has no prior program experience in this area.
- Barrier: lack of information, lack of actual savings data, technical approval etc. (also educating consumers about the high gas consumption of pool heaters is important).
- Role for FortisBC to pilot/test performance. Could talk to existing customers who use solar pool heaters.
- Fairly well established technology. Natural growth quite high. (REUS only showed about 1%). Delivery system should be well established.
- Could include indoor pools.
- Pool contractors are likely main installers (also Solar BC, possibly plumbers dealing with boilers).
- Panels on the roof are a cosmetic "turn off" for some people.

Action R4 – Ultra Low-Flow Showerheads

- Barriers: perception of low quality. Reduction of perceived service is an issue for some people.
- Take out rate probably fairly high (20%-25% is the approximate level in other jurisdictions)
- May be limited market (such as people who are energy price conscious, environmentally-conscious, landlords or other people who are not direct users of the shower being retrofitted).

Action R5 – Furnace Early Retirement

- Could be offered in conjunction with renovations so that furnace size could be reduced. Logic in grouping these is to avoid over sizing of equipment. Some incentive in terms of reduced equipment cost for furnace down sizing (approximately $200 for reducing from 80 to 60 MBH).
- Majority of furnaces are replaced at failure.
- REUS: 140,000 or more furnaces are older than 15 years in the Lower Mainland alone.
- EnerGuide credits are a driver during renovations.
- Potential partners: renovation contractors, energy advisors, service contractors.
- Potential to pay furnace service contractor incentive for replaced furnaces? (SPIFs can lead to unnecessary replacements).
- Interest-free loans/financing? (Dealers often offer financing.)
- Could incentivize replacement of furnaces older than a specific age (below mid-efficiency).
- Incentive could be distributed to customer or retailers/installers.
- Currently, incentives are $750/$1,000 through LiveSmart BC (for 95% furnace). FortisBC would have to incentivize beyond this.
- Little capacity within contracting community. Off-season program may be way to go.
- Close to 100% of LiveSmart participants replaced the furnace as part of their project.

Action R6 – Attic Insulation

- Not discussed during workshop.

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CONSERVATION POTENTIAL REVIEW-2010
FortisBC

Commercial Sector
Energy-efficiency & Alternative Energy Opportunities

Submitted to
FortisBC

Submitted by
ICF Marbek

April 26, 2011

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Executive Summary

Background and Objectives

This Conservation Potential Review (CPR) provides FortisBC Energy Utilities ("FortisBC") with a comprehensive planning document that the company can use on an ongoing basis to:

- Develop a long-range energy-efficiency strategy
- Design and implement energy-efficiency programs
- Assess the impact of energy-efficiency programs on both peak and annual loads
- Set annual energy-efficiency targets and budgets.

Summary of Findings

This report covers the results for the Commercial sector; results for the Residential and Industrial sectors are provided in separate reports.

The study findings confirm the existence of significant potential cost-effective natural gas efficiency improvements in British Columbia's Commercial sector. In the *most likely* and *aggressive* Achievable scenarios those energy-efficiency improvements would provide between 4,915,000 and 6,633,000 GJ/yr. of savings in 2030 as well as peak day load reductions of approximately 38,000 to 51,000 GJ. Savings are primarily associated with the space heating and water heating end uses, with approximately two-thirds of the savings in both Achievable scenarios associated with space heating measures.

Four measures each account for more than 10% of the savings in both the *most likely* and *aggressive* Achievable scenarios. These are, in order of their contribution; operations & maintenance measures, advanced building automation systems/recommissioning, high efficiency boilers, and low flow plumbing fixtures. These four measures represent 69% of the *most likely* Achievable scenario savings and 65% of the *aggressive* Achievable scenario savings.

Scope

Sector Coverage: The study addresses three sectors: Residential, Commercial/Institutional (this report) [1] and Industrial. In contrast to the 2006 CPR, which excluded FortisBC's (then, Terasen Gas) 300 largest manufacturing accounts, this CPR includes all of FortisBC's customers.

Geographical Coverage: The study results are presented for the total FortisBC service region and for the five service areas of: Lower Mainland, Vancouver Island, Whistler, Northern Inland and Southern Inland.

Study Period: The Base Year for this study is calendar year 2010. The time period covered by this study is to 2030, with milestones at the intervening years of 2015, 2020 and 2025.

Technologies: The study addresses energy-efficiency, customer behaviour and alternative energy options such as renewables and combined heat and power technologies.

[1] Throughout this report, use of the word "commercial" includes both commercial and institutional buildings unless otherwise noted.

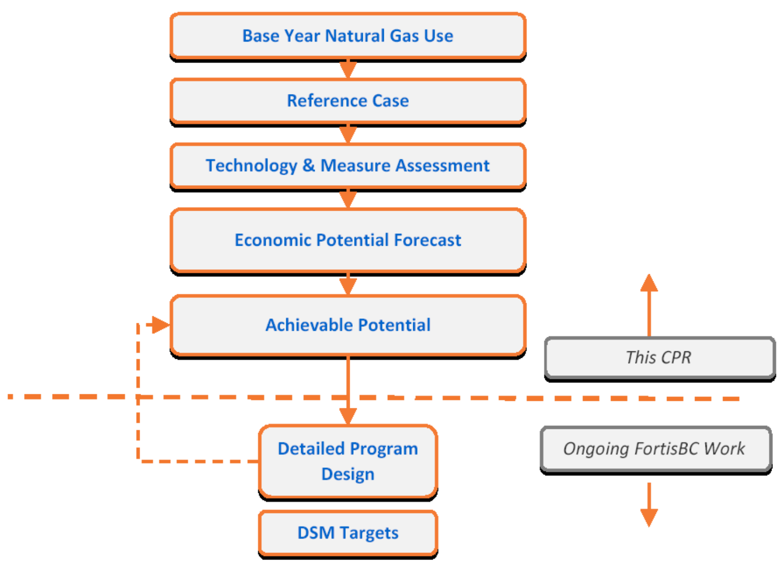
Relation to Previous B.C. CPRs: This study builds on the substantial body of information and modelling work prepared in previous CPR studies conducted for FortisBC (then Terasen Gas) (2006) and BC Hydro (2007). The data set for this study, however, includes FortisBC customers only, an important difference in relation to the above-mentioned studies.

Approach

The detailed end-use analysis of energy-efficiency opportunities in the Commercial sector employed two linked modelling platforms: CEEAM (Commercial Energy and Emissions Analysis Model), an in-house commercial building energy-use simulation modeling platform, and CSEEM (Commercial Sector Energy End-use Model), a spreadsheet-based macro model, also developed by Marbek in-house.

The major steps involved in the analysis are shown in Exhibit ES 1 and are discussed in Section 2. As illustrated, the results of this CPR study, and in particular the estimation of Achievable Potential, support on-going demand side management (DSM) planning work. However, it should be emphasized that the estimation of Achievable Potential is not synonymous with either the setting of specific program targets or with program design.

Exhibit ES 1 CPR 2010: Main Analytical Steps



Base Year Natural Gas Use

In the Base Year of 2010, FortisBC's Commercial sector customers consumed approximately 57,000,000 GJ. Exhibits E2 and E3, respectively, provide additional details on the major end uses and sub sectors where Commercial sector natural gas consumption occurs.

Exhibit ES 2 shows that space heating accounts for approximately 59% of the total Commercial sector natural gas use. Domestic hot water heating is the next largest end use, accounting for approximately 25% of total commercial natural gas use, followed by commercial cooking (9%). Other end uses such as dehumidification, steam system distribution losses, laundry equipment, and pool heating account for about 7% of commercial natural gas use.

Exhibit ES 3 shows that Small Commercial buildings account for about 30% of natural gas consumption followed by Large and Medium Apartments, (approximately 25% combined). No other sub sector accounts for more than 10% of Commercial sector natural gas use.

Exhibit ES 2 Base Year Commercial Natural Gas Consumption by End Use[2]

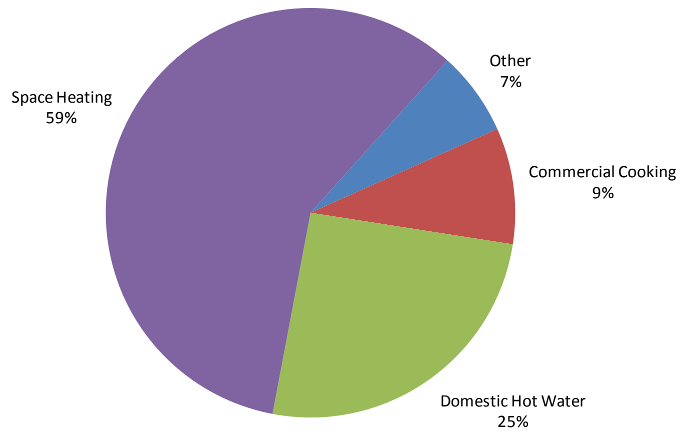
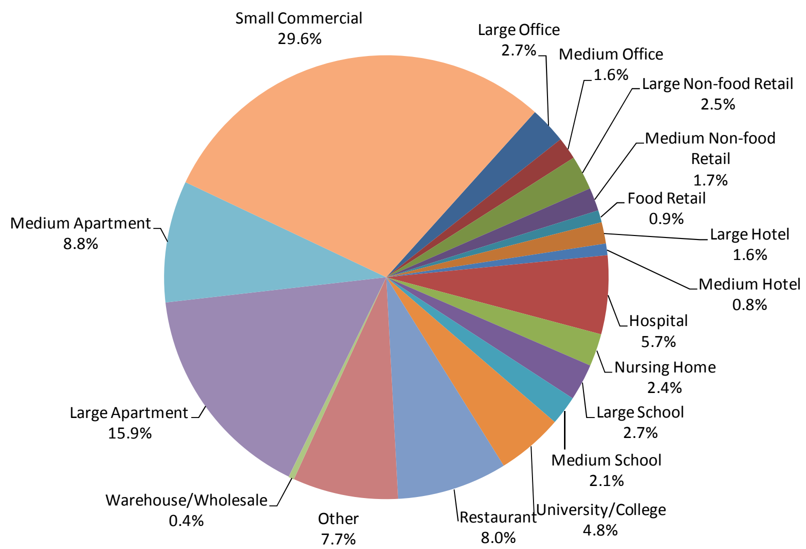


Exhibit ES 3 Base Year Commercial Natural Gas Consumption by Sub Sector



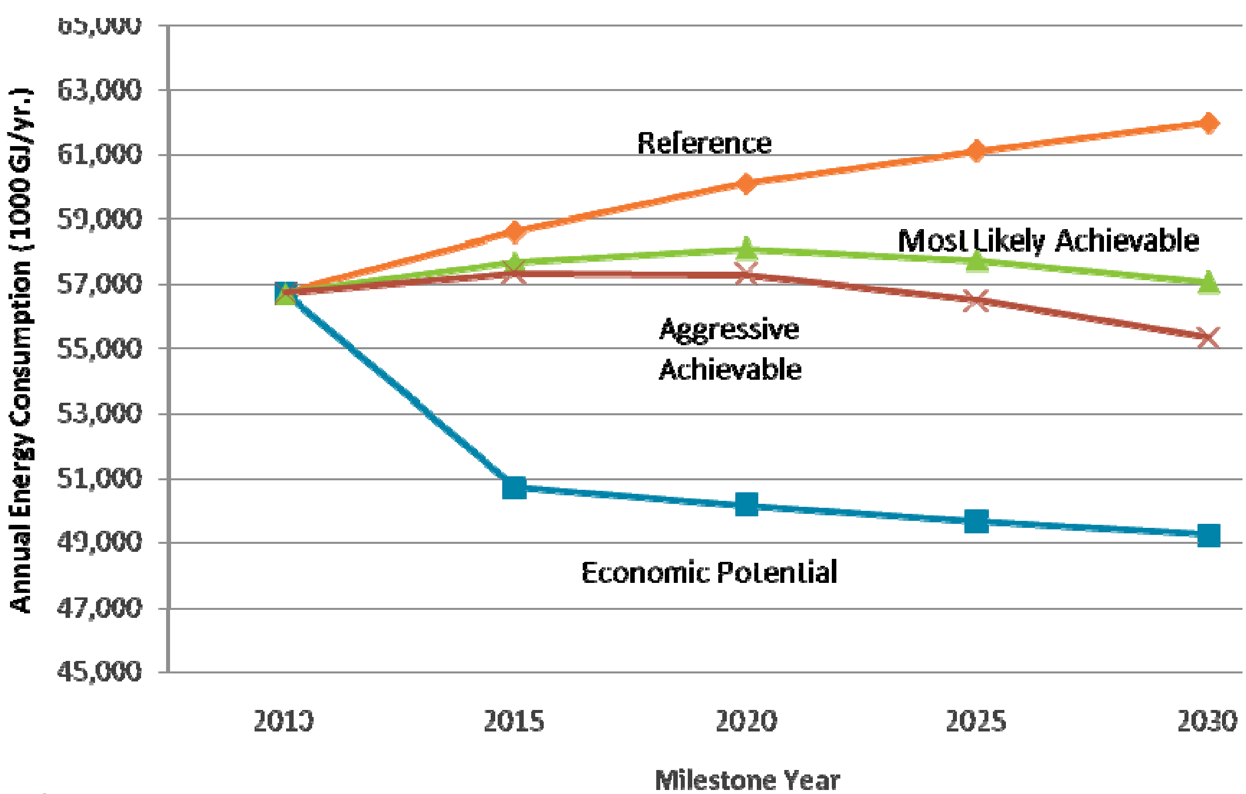
[2] End-use distributions shown are based on the results of modelled sub sectors.

Results and Findings

A summary of the levels of annual natural gas consumption contained in the Reference Case and each of three energy-efficiency forecasts, by milestone year, is presented in Exhibit ES 4 and discussed briefly in the paragraphs below.

Exhibit ES 4 Summary of Forecast Results, Energy Efficiency (1000 GJ/yr.)

	Annual Consumption (1000 GJ/year)					Potential Annual Savings		
				Achievable			Achievable	
Year	Base Year	Ref. Case	Economic	Most Likely	Aggressive	Economic	Most Likely	Aggressive
2010	56,730	56,730						
2015		58,607	50,714	57,676	57,332	7,893	930	1,275
2020		60,095	50,137	58,104	57,286	9,958	1,991	2,809
2025		61,118	49,622	57,739	56,498	11,496	3,379	4,619
2030		61,977	49,225	57,062	55,344	12,752	4,915	6,633



Reference Case

In the absence of continued DSM initiatives, the study estimates that natural gas consumption in the Commercial sector will increase from the Base Year (2010) consumption of approximately 56,730,000 GJ/yr. to 60,095,000 GJ/yr. by 2020 and 61,977,000 GJ/yr. by 2030. This represents an overall increase of about 9% in the period.

Economic Potential Forecast

Under the conditions of the Economic Potential Forecast, the study estimated that consumption in the Commercial sector would decline to about 49,225,000 GJ/yr. by 2030. Annual savings relative to the Reference Case are about 12,752,000 GJ/yr. or about 22%. The Economic Potential annual savings are about 9,958,000 GJ/yr. in 2020.

Achievable Potential – Energy-efficiency Scenario

A selection of the natural gas savings opportunities identified in the Economic Potential Forecast was discussed in a full-day workshop. The guided participant discussions provided estimated levels of participation under a *most likely* scenario of program activity and an *aggressive* scenario of program activity. These levels were applied to the Economic Potential savings to estimate the Achievable Potential for these two scenarios. For technologies not specifically discussed in the workshops, participation levels were estimated through extrapolation from the technologies that were discussed. Results by sub sector, end use and individual measure for both Achievable scenarios are presented in Exhibit ES 5 through ES 12.

Exhibit ES 5 Natural Gas Savings for the Total FortisBC Service Area by Sub Sector and Milestone Year (GJ/yr.) - Most Likely Achievable Scenario

Sub Sector	2015	2020	2025	2030	% Savings 2030 Relative to Ref Case	% Savings 2030 Relative to Total 2030 Savings
Large Office	24,277	57,168	99,977	149,995	9.2%	3.1%
Medium Office	11,346	27,074	47,932	72,760	7.3%	1.5%
Large Non-food Retail	20,917	47,712	81,972	122,602	8.5%	2.5%
Medium Non-food Retail	9,807	23,404	41,876	64,888	6.4%	1.3%
Food Retail	7,203	15,799	26,761	39,464	7.1%	0.8%
Large Hotel	16,518	33,401	55,435	78,616	8.1%	1.6%
Medium Hotel	7,508	15,243	26,004	37,315	7.2%	0.8%
Hospital	80,698	170,956	277,576	391,187	11.4%	8.0%
Nursing Home	26,398	57,289	97,519	142,823	9.7%	2.9%
Large School	27,555	64,558	113,648	171,773	10.6%	3.5%
Medium School	18,021	44,991	83,334	131,953	10.2%	2.7%
University/College	43,296	100,234	175,426	263,195	9.0%	5.4%
Restaurant	80,193	153,480	247,093	334,494	6.7%	6.8%
Warehouse/Wholesale	4,107	10,509	18,011	26,457	10.4%	0.5%
Large Apartment	162,979	335,511	559,831	794,581	8.4%	16.2%
Medium Apartment	87,951	173,542	283,684	390,100	7.4%	7.9%
Small Commercial	241,293	527,453	911,955	1,357,598	7.1%	27.6%
Other	60,181	132,367	230,676	345,306	6.9%	7.0%
Grand Total	**930,246**	**1,990,692**	**3,378,709**	**4,915,107**	**7.9%**	**100%**

Note: Any difference in totals is due to rounding.

Exhibit ES 6 Natural Gas Savings for the Total FortisBC Service Area by Sub Sector and Milestone Year (GJ/yr.) - Most Likely Achievable Scenario

End Use	2015	2020	2025	2030	% Savings 2030 Relative to Ref Case	% Savings 2030 Relative to Total 2030 Savings
Commercial Cooking	4,717	36,212	83,000	151,441	2.7%	3%
Domestic Hot Water	400,468	683,643	1,067,311	1,367,484	9.2%	28%
Space Heating	525,061	1,270,837	2,228,397	3,396,181	10.2%	69%
Grand Total	**930,246**	**1,990,692**	**3,378,709**	**4,915,107**	**7.9%**	**100%**

Note: Any difference in totals is due to rounding.

Exhibit ES 7 Natural Gas Savings for the Total FortisBC Service Area by Measure and Milestone Year (GJ/yr.) - Most Likely Achievable Scenario

End Use	Measure	2015	2020	2025	2030	% Savings Relative to Total 2030 Savings	Average B/C Ratio
Domestic Hot Water	Pre-Rinse Spray Valves	57,607	84,693	110,297	107,352	2.2%	16.70
Domestic Hot Water	Ultra Low-Flow Fixtures	195,943	288,323	376,043	366,771	7.5%	8.61
Space Heating	Demand Ctrl Kitchen Vent.	4,091	7,913	11,414	14,537	0.3%	5.27
Domestic Hot Water	Condensing DHW (Boiler)	1,665	12,285	39,274	89,919	1.8%	3.08
Multiple	New Construction 40% Better	1,429	10,292	31,621	70,396	1.4%	3.07
Space Heating	Programmable T'stats	54,957	107,153	155,816	200,101	4.1%	2.77
Domestic Hot Water	Condensing DHW (Tank Type)	1,815	13,390	42,773	73,296	1.5%	2.58
Multiple	BAS and Recommissioning	162,255	316,967	461,728	593,864	12.1%	2.49
Space Heating	Air Sealing	895	3,522	7,737	13,290	0.3%	1.86
Space Heating	Condensing Rooftop Units	847	3,268	7,025	11,780	0.2%	1.83
Space Heating	Condensing Boilers	35,149	135,083	290,443	490,417	10.0%	1.70
Commercial Cooking	HE Cooking	3,188	24,210	54,931	98,972	2.0%	1.62
Space Heating	Air-Air Heat Recovery	54,621	105,301	151,557	192,958	3.9%	1.52
Multiple	O&M Measures	50,292	197,566	436,475	761,752	15.5%	1.38
Space Heating	Roof Insulation	1,981	14,928	48,739	112,200	2.3%	1.26
Space Heating	Condensing Unit Heater	60	232	496	832	0.0%	1.21
Domestic Hot Water	Drainwater Heat Recovery	335	1,234	2,614	4,439	0.1%	1.19
Space Heating	HVLS Fans	687	1,322	1,896	2,394	0.0%	1.19
Space Heating	Demand Ctrl Vent.	953	1,831	2,610	3,264	0.1%	1.17
Space Heating	Infrared Heaters	0	1,360	2,589	3,666	0.1%	1.16
Multiple	Small Commercial	241,293	527,453	911,955	1,357,598	27.6%	-
Multiple	Other	60,181	132,367	230,676	345,306	7.0%	-
Grand Total		930,246	1,990,692	3,378,709	4,915,107	100%	3.20

Note that individual measures were not applied in the "Small Commercial" and "Other" sub sectors. Potential savings in these subsectors are estimated based on results of detailed modelling and analysis in other subsectors. See section 3.1 for a description of the treatment of these two sub sectors.

Exhibit ES 8 Natural Gas Savings for the Total FortisBC Service Area by Sub Sector and Milestone Year (GJ/yr.) - Aggressive Achievable Scenario

Sub Sector	2015	2020	2025	2030	% Savings 2030 Relative to Ref Case	% Savings 2030 Relative to Total 2030 Savings
Large Office	37,780	83,090	135,372	194,245	12.0%	2.9%
Medium Office	19,002	40,986	65,942	93,936	9.5%	1.4%
Large Non-food Retail	33,849	70,919	112,351	159,090	11.0%	2.4%
Medium Non-food Retail	17,395	36,763	59,078	85,388	8.5%	1.3%
Food Retail	10,831	22,970	36,618	52,316	9.5%	0.8%
Large Hotel	20,380	45,137	74,315	108,525	11.2%	1.6%
Medium Hotel	9,361	20,977	35,537	52,436	10.1%	0.8%
Hospital	112,451	236,757	371,286	504,625	14.8%	7.6%
Nursing Home	35,922	79,818	132,244	189,305	12.8%	2.9%
Large School	41,735	93,190	155,328	221,209	13.6%	3.3%
Medium School	29,100	67,276	116,353	173,984	13.5%	2.6%
University/College	64,132	143,671	238,480	339,732	11.6%	5.1%
Restaurant	86,980	197,907	328,911	479,294	9.5%	7.2%
Warehouse/Wholesale	6,488	15,293	24,641	34,726	13.7%	0.5%
Large Apartment	222,518	475,179	764,111	1,080,620	11.5%	16.3%
Medium Apartment	107,842	233,700	383,163	543,783	10.3%	8.2%
Small Commercial	334,939	753,649	1,263,001	1,846,194	9.6%	27.8%
Other	84,288	191,639	322,624	473,670	9.4%	7.1%
Grand Total	**1,274,993**	**2,808,920**	**4,619,354**	**6,633,079**	**10.7%**	**100%**

Note: Any difference in totals is due to rounding.

Exhibit ES 9 Natural Gas Savings for the Total FortisBC Service Area by End Use and Milestone Year (GJ/yr.) - Aggressive Achievable Scenario

End Use	2015	2020	2025	2030	% Savings 2030 Relative to Ref Case	% Savings 2030 Relative to Total 2030 Savings
Commercial Cooking	7,389	56,761	130,108	236,763	4.2%	4%
Domestic Hot Water	383,670	841,837	1,410,241	2,056,516	13.8%	31%
Space Heating	883,934	1,910,322	3,079,005	4,339,801	13.0%	65%
Grand Total	**1,274,993**	**2,808,920**	**4,619,354**	**6,633,079**	**10.7%**	**100%**

Note: Any difference in totals is due to rounding.

Exhibit ES 10 Natural Gas Savings for the Total FortisBC Service Area by Measure and Milestone Year (GJ/yr.) - Aggressive Achievable Scenario

End Use	Measure	2015	2020	2025	2030	% Savings Relative to Total 2030 Savings	Average B/C Ratio
Domestic Hot Water	Pre-Rinse Spray Valves	41,645	81,398	119,287	155,341	2.3%	16.70
Domestic Hot Water	Ultra Low-Flow Fixtures	141,808	277,565	407,352	531,248	8.0%	8.61
Space Heating	Demand Ctrl Kitchen Vent.	5,599	10,760	15,463	19,670	0.3%	5.27
Domestic Hot Water	Condensing DHW (Boiler)	3,129	22,869	72,630	163,162	2.5%	3.08
Multiple	New Construction 40% Better	9,819	37,046	77,103	129,782	2.0%	3.07
Space Heating	Programmable T'stats	68,187	132,389	192,234	243,154	3.7%	2.77
Domestic Hot Water	Condensing DHW (Tank Type)	3,418	24,969	79,015	131,989	2.0%	2.58
Multiple	BAS and Recommissioning	201,268	391,471	569,360	699,843	10.6%	2.49
Space Heating	Air Sealing	4,262	8,345	12,163	15,573	0.2%	1.86
Space Heating	Condensing Rooftop Units	1,155	4,405	9,364	15,529	0.2%	1.83
Space Heating	Condensing Boilers	48,013	182,990	391,328	660,997	10.0%	1.70
Commercial Cooking	HE Cooking	4,959	37,659	85,447	153,957	2.3%	1.62
Space Heating	Air-Air Heat Recovery	74,708	143,060	205,251	262,327	4.0%	1.52
Multiple	O&M Measures	241,403	474,158	698,360	914,103	13.8%	1.38
Space Heating	Roof Insulation	3,442	25,847	84,415	195,136	2.9%	1.26
Space Heating	Condensing Unit Htr.	82	313	665	1,109	0.0%	1.21
Domestic Hot Water	Drainwater Heat Recovery	630	2,292	4,797	7,910	0.1%	1.19
Space Heating	HVLS Fans	939	1,793	2,554	3,207	0.0%	1.19
Space Heating	Demand Ctrl Vent.	1,298	2,464	3,469	4,295	0.1%	1.17
Space Heating	Infrared Heaters	0	1,838	3,474	4,884	0.1%	1.16
Multiple	Small Commercial	334,939	753,649	1,263,001	1,846,194	27.8%	-
Multiple	Other	84,288	191,639	322,624	473,670	7.1%	-
Grand Total		1,274,993	2,808,920	4,619,354	6,633,079	100%	3.32

Note that individual measures were not applied in the "Small Commercial" and "Other" sub sectors. Potential savings in these subsectors are estimated based on results of detailed modelling and analysis in other subsectors. See section 3.1 for a description of the treatment of these two sub sectors.

Peak Day Load Impacts – Energy-efficiency Scenarios

The peak day savings associated with each of the Achievable energy-efficiency scenarios were calculated using load factor data provided by FortisBC. The results are summarized in Exhibit ES 11 and Exhibit ES 12. As illustrated, the Achievable peak day savings in 2030 range from a decrease of about 38,000 GJ (*most likely* scenario) to a decrease of approximately 51,000 GJ (*aggressive* scenario) for the total FortisBC service region.

Exhibit ES 11 Peak Day Capacity Impacts, By Scenario, Service Region and Milestone Year (GJ) - Most Likely Achievable Scenario

Year	Lower Mainland	Vancouver Island	Southern Interior	Northern Interior	Whistler	Grand Total
2015	4,714	744	802	849	31	7,141
2020	9,904	1,675	1,753	1,883	66	15,281
2025	16,637	2,977	3,012	3,197	113	25,936
2030	23,786	4,537	4,502	4,740	164	37,729
Savings 2030 Relative to Total 2030 Savings	**63%**	**12%**	**12%**	**13%**	**0.4%**	**100%**

Exhibit ES 12 Peak Day Capacity Impacts, By Scenario, Service Region and Milestone Year (GJ) – Aggressive Achievable Scenario

Year	Lower Mainland	Vancouver Island	Southern Interior	Northern Interior	Whistler	Grand Total
2015	6,424	1,058	1,061	1,202	42	9,787
2020	13,983	2,461	2,401	2,623	94	21,562
2025	22,688	4,212	4,092	4,314	154	35,459
2030	32,115	6,298	6,100	6,182	221	50,917
Savings 2030 Relative to Total 2030 Savings	**63%**	**12%**	**12%**	**12%**	**0.4%**	**100%**

Greenhouse Gas Impacts – Energy-efficiency Scenarios

The natural gas savings associated with each of the Achievable energy-efficiency scenarios shown in Exhibit ES 13 and Exhibit ES 14 would result in significant greenhouse gas (GHG) reductions. The study estimated that in 2030 the natural gas efficiency measures contained in the *aggressive* and *most likely* Achievable Potential scenarios would reduce GHG emissions by, respectively, 338,000 and 250,000 of CO_2e/yr.

Exhibit ES 13 Estimated GHG Emission Reductions, By Scenario and Milestone Year (tonnes CO_2e/yr.) – Most Likely Achievable Scenario

Year	Lower Mainland	Vancouver Island	Southern Interior	Northern Interior	Whistler	Grand Total
2015	31,274	4,933	5,321	5,635	206	47,369
2020	65,701	11,108	11,626	12,493	440	101,368
2025	110,366	19,747	19,978	21,209	747	172,047
2030	157,787	30,100	29,865	31,444	1,087	250,283
Savings 2030 Relative to Total 2030 Savings	**63%**	**12%**	**12%**	**13%**	**0.4%**	**100%**

Exhibit ES 14 Estimated GHG Emission Reductions, By Scenario and Milestone Year (tonnes CO_2e/yr) – Aggressive Achievable Scenario

Year	Lower Mainland	Vancouver Island	Southern Interior	Northern Interior	Whistler	Grand Total
2015	42,613	7,020	7,035	7,974	282	64,924
2020	92,758	16,325	15,927	17,402	620	143,033
2025	150,501	27,939	27,145	28,617	1,021	235,222
2030	213,041	41,776	40,468	41,012	1,468	337,765
Savings 2030 Relative to Total 2030 Savings	**63%**	**12%**	**12%**	**12%**	**0.4%**	**100%**

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APPENDICES (Bound Separately)

List of Exhibits

1 Introduction

1.1 Background and Objectives

This Conservation Potential Review (CPR) provides FortisBC (formerly Terasen Gas) with a comprehensive planning document that the company can use on an ongoing basis to:

- Develop a long-range energy-efficiency strategy
- Design and implement energy-efficiency programs
- Assess the impact of energy-efficiency programs on both peak and annual load
- Set annual energy-efficiency targets and budgets.

1.2 Study Scope

Sector Coverage: The study addresses three sectors: Residential, Commercial/Institutional[3] and Industrial. In contrast to the 2006 CPR, which excluded FortisBC's 300 largest manufacturing accounts, this CPR includes all of FortisBC's customers.

Geographical Coverage: The study results are presented for the total FortisBC service region and for the five service areas of: Lower Mainland, Vancouver Island, Whistler,[4] Northern Interior, and Southern Interior.

Study Period: The Base Year for this study is calendar year 2010. The time period covered by this study is to 2030, with milestones at the intervening years of 2015, 2020, and 2025.

Technologies: The study addresses energy-efficiency, customer behaviour and alternative energy options such as renewables and combined heat and power technologies.

Relation to Previous B.C. CPRs: This study builds on the substantial body of information and modelling work prepared in previous CPR studies conducted for FortisBC (then Terasen Gas) (2006) and BC Hydro (2007). The data set for this study, however, includes FortisBC customers only, an important difference in relation to the above-mentioned studies.

1.2.1 *Data Caveat*

As in any study of this type, the results presented in this report are based on a large number of important assumptions. Assumptions such as those related to the current penetration of energy-efficient technologies, the rate of future growth in the stock of commercial buildings and customer willingness to implement new energy-efficiency measures are particularly influential. Wherever possible, the assumptions used in this study are consistent with those used by FortisBC and are based on best available information, which in many cases includes the professional judgement of the consultant team, FortisBC personnel and local experts. The reader should, therefore, use the results presented in this report as best available estimates; major assumptions, information sources and caveats are noted throughout the report.

[3] Throughout this report, use of the word "commercial" includes both commercial and institutional buildings unless otherwise noted.
[4] Due to data limitations, sales data for the Whistler service region are not disaggregated by sub sector and include all non-residential sales.

1.3 Study Organization

The study has been organized into four areas:

- **Three individual sector reports** (Residential, Commercial and Industrial) that provide an assessment of the technical opportunities for more efficient use of natural gas within each sector. A summary report will bring together the findings of all three sectors.
- **A commercial end-use survey (CEUS)** that provides insight into current natural gas equipment efficiency levels, fuel share and annual consumption levels within key commercial sub sectors. The CEUS results were used to refine the Commercial sector building archetypes employed in the assessment of technical opportunities.
- **A summary and employment impact report** that brings together the findings of the Residential, Commercial and Industrial sectors, together with an estimate of the net job creation and other economic effects attributable to the achievable efficiency results within the three sectors.
- **An options paper** that outlines alternative approaches to the assessment of cost-effective levels of DSM activity outside of the California Standard Practice tests.

1.4 This Report

This report presents the Commercial sector results and is organized as follows:

- **Section 2** presents an overview of the study methodology, including a definition of key terms and an outline of the major analytic steps involved.
- **Section 3** presents a profile of Commercial sector Base Year natural gas use in the total FortisBC service area as well as in the five individual service regions.
- **Section 4** presents the Commercial sector Reference Case, which provides a detailed estimate of natural gas use within the total FortisBC service area and each of the five service regions over the study period 2010 to 2030, in the absence of new DSM program initiatives.
- **Section 5** identifies and assesses the economic attractiveness of energy-efficiency behaviour and alternative energy technology options within the Commercial sector.
- **Section 6** presents the Commercial sector Economic Potential Forecast for the study period 2010 to 2030.
- **Section 7** estimates the proportion of energy savings identified in the Economic Potential Forecast that can realistically be achieved within the study period. Impacts on peak day loads and greenhouse gas emissions are also presented.
- **Section 8** lists sources and references.
- **Section 9** is a glossary of terms.

1.5 Results Presentation

The preparation of Conservation Potential Reviews involves the compilation and analysis of an enormous amount of market and technology data and a nearly infinite number of ways of organizing and presenting the results. It is recognized that readers will have differing needs with respect to the level of detail that they require. Consequently, the results of this CPR are presented at three levels of detail.

- **Main report body:** The main body of the report provides a relatively high level reporting of the main steps involved in undertaking each stage of the study together with a concise summary of results, including comments and interpretation of key findings. It is assumed that the content and level of detail in the main report body is suitable for the majority of readers who wish to gain an understanding of the potential contribution of energy-efficiency and alternative energy options to FortisBC's long-term natural gas requirements.

- **Appendices:** A separate appendix accompanies each major chapter of the main report. Each appendix provides more detailed information on the methodology employed, including major assumptions or sample calculations as applicable, together with additional detailed results. It is assumed that this presentation is better suited to DSM analysts and managers wishing a more thorough understanding of the study results.

- **Software:** All of the data generated by the study is provided in two custom-designed Excel models: Data Manager and the Measure TRC model.

  - Data Manager is a custom-designed query protocol that enables the user to search and report the study results in a virtually infinite number of combinations. Data Manager is intended to support the most detailed level of DSM activity, DSM program design, preparation of regulatory submissions etc.

  - The Measure TRC model is a custom-designed model that provides comprehensive profiles of all of the DSM measures assessed within the study. Because the information is provided is software form, any changes to economic, financial or performance data inputs can be easily accommodated and revised results generated automatically.

2 Study Methodology

This section provides an overview of the methodology employed for this study. More specifically, it addresses:

- Definition of terms
- Major analytical steps
- Key economic inputs
- Analytic models.

2.1 Definition of Terms

This study employs numerous terms that are unique to analyses such as this one and consequently it is important to ensure that all readers have a clear understanding of what each term means when applied to this study. Below is a brief description of some of the most important terms.

Base Year — The Base Year is the starting point for the analysis. It provides a detailed description of "where" and "how" energy is currently used in the existing Commercial sector building stock. Building energy-use simulations were undertaken for each building type to support the construction of the Base Year.

Reference Case (includes Natural Conservation) — The Reference Case estimates the expected level of natural gas consumption that would occur over the study period in the absence of new DSM program initiatives. It provides the point of comparison for the subsequent calculation of "economic" and "achievable" savings potentials. Creation of the Reference Case required the development of detailed profiles for new buildings in each of the building segments, estimation of the expected growth in building stock, estimation of the likely impacts of new building and equipment standards and, finally an estimation of "natural" changes affecting energy consumption over the study period.

Technology Assessment — Energy-efficiency and alternative energy options were identified that met the criteria, as outlined above in the study's scope. Technology cost and performance data were compiled relative to the baseline technology and the measure total resource cost (TRC) was calculated for each option.

The measure TRC calculates the net present value of energy savings that result from an investment in an efficiency, behaviour or alternative energy technology or measure. The measure TRC is equal to its full or incremental capital cost (depending on application) plus any change (positive or negative) in the combined annual energy and O&M costs. This calculation includes, among others, the following inputs: the avoided natural gas and electricity supply costs, the life of the technology, and the selected discount rate, which in this analysis has been set at 7.38% for most of the regions and 6.87% for Vancouver Island.

Economic Potential Forecast — The Economic Potential Forecast is the level of energy consumption that would occur if all buildings were upgraded to the level that is cost effective, from FortisBC's perspective, when using lifecycle costing with the long-run avoided cost of new natural gas supply. All the energy-efficiency, behaviour and alternative energy options included in the technology assessment that had a positive measure TRC were incorporated into the Economic Potential Forecast.

Achievable Potential

The Achievable Potential is the proportion of the savings identified in the Economic Potential Forecast that could realistically be achieved within the study period. Achievable Potential recognizes that it is difficult to induce customers to purchase and install all the energy-efficiency/alternative energy or behaviour options that meet the criteria defined by the Economic Potential Forecast. The results are presented as a range, defined as *most likely* and *aggressive*.

Estimates provided were developed in a workshop involving FortisBC energy-efficiency program personnel, trade allies, selected external experts and the consulting team.

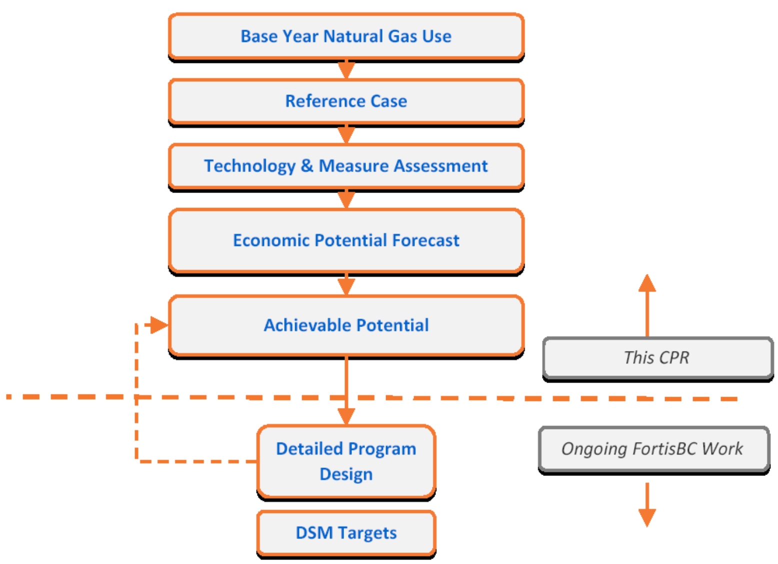
Peak Day Load Impacts

Load factors provided by FortisBC were used to derive peak day load impacts from the energy consumption values contained in each of the potential estimates noted above.

2.2 Overview of Approach

To meet the objectives outlined above, the study was conducted within an iterative process that involved a number of well-defined steps, as outlined in Exhibit 1. At the completion of each step, the client reviewed the results and, as applicable, revisions were identified and incorporated into the interim results. The study then progressed to the next step.

Exhibit 1 CPR 2010: Main Analytical Steps



A summary of the steps is presented below.

Step 1: Develop Base Year Calibration Using Actual FortisBC Billing Data

- Compile and analyze available data on British Columbia's existing building stock.
- Develop detailed technical descriptions of the existing building stock.
- Undertake computer simulations of energy use in each building type and compare these with actual building billing and audit data.
- Compile actual FortisBC billing data.
- Create sector model inputs and generate results.
- Calibrate sector model results using actual billing data.

Step 2: Develop Reference Case

- Compile and analyze building design, equipment and operations data and develop detailed technical descriptions of the new building stock.
- Develop computer simulations of energy use in each new building type.
- Compile data on forecast levels of building stock growth and "natural" changes in equipment efficiency levels and/or practices.
- Define sector model inputs and create forecasts of energy use for each of the milestone years.
- Calibrate with FortisBC Forecast.

Step 3: Develop and Assess Energy-efficiency and Alternative Energy Options

- Develop list of energy-efficiency and alternative energy measures.
- Compile detailed cost and performance data for each measure.
- Identify the baseline technologies employed in the Reference Case.
- Develop energy-efficiency and/or alternative options for each end use.
- Compile economic data, including current and forecast costs for new supply of natural gas and electricity generation.
- Determine the measure TRC for each energy-efficiency and alternative energy option.

Step 4: Estimate Economic Energy-efficiency and Alternative Energy Potential

- Screen the identified energy-efficiency and alternative energy measures from Step 3 against the economic data.
- Identify the combinations of energy-efficiency measures and building types where the measure TRC is positive.
- Apply the economically attractive energy-efficiency measures from Step 3 within the energy-use simulation model developed previously for each building type.
- Determine annual natural gas consumption in each building type when the economic efficiency measures are employed.
- Compare the consumption levels when all economic efficiency measures are used with the Reference Case consumption levels and calculate the natural gas consumption impacts.

Step 5: Estimate Achievable Savings Potential

- "Bundle" the energy-efficiency, alternative energy and customer behaviour options identified in the Economic Potential Forecast into a set of Actions.
- Create "Action Profiles" for each of the identified Actions that provide a high level rationale and direction, including target technologies and sub markets as well as key barriers and a broad intervention strategy.
- Review historical Achievable program results and prepare preliminary Action Assessment Worksheets.

- Consult with FortisBC personnel, review preliminary estimates and reach general agreement on *most likely* and *aggressive* range of Achievable Potential.

Step 6: Estimate Peak Day Load Impacts of Economic and Achievable Savings Potential

- Annual energy decreases/increases contained in each of the energy-efficiency/alternative energy forecasts were converted to average daily values based on annual load profile data provided by FortisBC.
- Load factors that correlate "average" to "peak" consumption were provided by FortisBC for each rate class and service region.
- Peak day load impacts were calculated for each of the energy-efficiency and fuel choice scenario results by applying the above load factors.

2.3 Analytical Models

The analysis of the Commercial sector employs two linked modelling platforms. They are:

- CEEAM (Commercial Energy and Emissions Analysis Model), an in-house, simulation model developed in conjunction with Natural Resources Canada (NRCan) for modelling energy use in commercial/institutional building stock.
- CSEEM *(*Commercial Sector Energy End-use Model), an in-house spreadsheet-based macro model.

CEEAM was used to develop commercial energy end-use intensities (EUIs) for each of the commercial and institutional building archetypes. CEEAM has been successfully employed in numerous domestic and international CDM projects. Domestically, this includes assignments for BC Hydro, FortisBC, Manitoba Hydro, the Ontario Power Authority, Enbridge Gas, Union Gas, NB Power, Newfoundland Power, Newfoundland Labrador Hydro and NRCan. CEEAM is a robust modelling platform and its results have been verified against actual end-use metered data for commercial buildings in the cities of Ottawa and Toronto and against commercially supported software.[5]

CEEAM was developed specifically for applications such as this study. One of its particular strengths is the capability to simulate energy performance not only in a given building but also in an entire stock of similar buildings (e.g., all Large Offices). In particular, it is capable of tracking the penetration of multiple technologies in combinations that are not possible in most commercially available simulation software.

CEEAM simulates the energy consumption and peak load for all energy end uses present in a given commercial building segment. CEEAM calculates energy use and emissions by end use and reports them in kWh/ft^2/yr. and kg eCO_2/ft^2. Because CEEAM is a full modelling program, it calculates both building heating and cooling loads (internal and transmission). It therefore accounts for interactive effects such as the increase in heating energy use and decrease in cooling energy use resulting from lighting retrofits. CEEAM also uses equipment part load performance curves to accurately model the seasonal efficiency of heating and cooling plants.

The commercial EUIs derived by CEEAM provide inputs into CSEEM. CSEEM consists of two modules:

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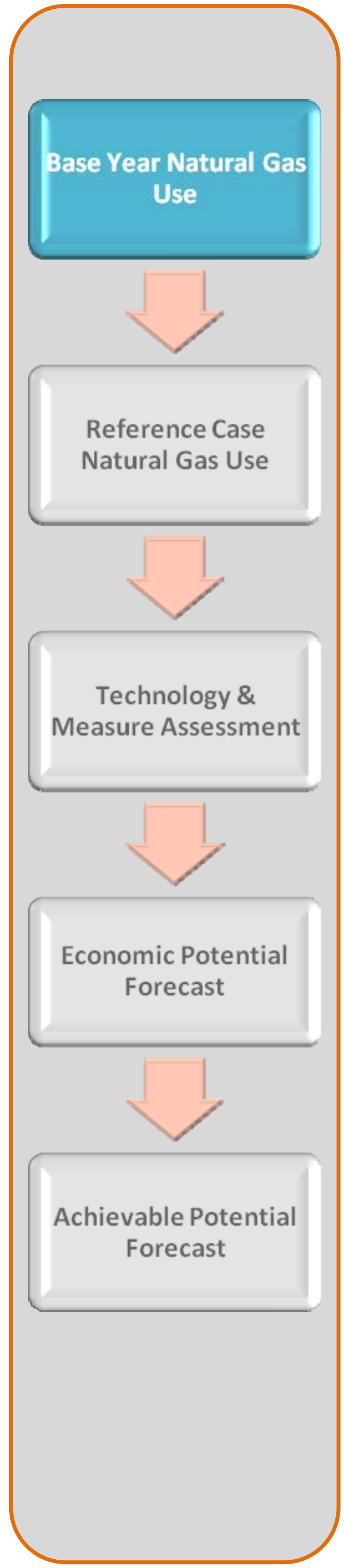
[5] CEEAM results have been verified against results generated by DOE-2.1E, a commercially supported building energy simulation software developed and maintained by the U.S. Department of Energy.

- A general parameters module that contains general sector data (e.g., floor space, growth rates, etc.)
- A building profile module that contains the EUI data for each of the selected building sub sectors.

CSEEM combines data from each of these modules and provides total energy use by service region, building sub sector and end use. CSEEM also enables the analyst to estimate the demand impacts of the energy-efficiency measures introduced in the Economic Potential Forecast.

3 Base Year (2010) Natural Gas Use



This section provides a profile of Base Year (2010) natural gas use by FortisBC's Commercial sector customers. It outlines the steps involved in preparing the profile of Base Year natural gas use and presents a summary of the results.

Completion of this section of the study involved the following steps:

- FortisBC's Commercial sector customers were segmented into sub sectors containing buildings with similar energy-use patterns.
- The major energy end uses within the commercial buildings were selected.
- Detailed commercial building archetypes[6] developed in previous CPR studies for FortisBC and BC Hydro were updated using the results of recent Commercial End Use Surveys (CEUS) completed by FortisBC (as part of this study) and BC Hydro as well as other current information describing the commercial building stock. These archetypes were used to create building energy-use models for each sub sector.
- Utility sales data were compiled for each sub sector.
- Utility sales data were combined with the model results showing typical sub sector natural gas use to generate an estimate of floor area for each sub sector.
- The above data was combined using CSEEM to produce the detailed Base Year profile.

A brief description of each of the above steps is provided below, together with a summary of the results. Additional information is provided in Appendix A.

3.1 Commercial Sector Segmentation

The first task in developing the Base Year calibration involved the segmentation of the building stock into specific sub sectors. The choice of building sub sectors is driven by both data availability and the need to facilitate the subsequent analysis and modelling of potential energy-efficiency improvements.

For modelling and analysis of energy-efficiency opportunities, the selected building sub sectors must be reasonably similar in terms of major design and operating considerations, such as building size, typical mechanical systems, annual operating hours, etc.

A summary of the Commercial sub sectors that are used in this study is provided in Exhibit 2.

[6] Each building archetype contains detailed specifications of building envelope, equipment and operating practices for a "typical" building within a specific sub sector.

Exhibit 2 Commercial Sub Sectors

- Large Office
- Medium Office
- Large Non-Food Retail
- Medium Non-Food Retail
- Food Retail / Grocery
- Large Hotel
- Medium Hotel / Motel
- Hospital
- Nursing Home
- Large School
- Medium School
- University/College
- Restaurant
- Warehouse/Wholesale
- Large Apartment
- Medium Apartment
- Small Commercial*
- Recreation and Other*

*Note: Separate building archetypes were not developed for these sub sectors due to the wide variety of building types and equipment included within each.

Further details regarding the building types included in most of the sub sectors shown in Exhibit 2 are provided in Appendix A. Sub sector size cut-offs were chosen to align with both the 2006 CPR and the 2007 BC Hydro CPR. Additional detail is provided below:

- **Large Office, Large Hotel, Large Non-food Retail, Large Apartment**. For the purposes of this study, Large Offices, Large Hotels, Large Non-food Retail buildings and Large Apartments have been defined as buildings with a floor area greater than 100,000 ft^2. As actual floor area data are not available, annual consumption data were used to partition these sub sectors. These cut off points were chosen to align with the 2006 CPR as well as the most recent BC Hydro CPR. Office buildings with annual consumption greater than 3,500 GJ/yr.[7] (~35 MJ/ft^2/yr. * 100,000 ft^2), Hotels with annual consumption greater than 6,000 MJ/yr. (~60 MJ/ ft^2/yr. * 100,000 ft^2), Non-food Retail buildings with annual consumption greater than 3,000 MJ/yr. (~30 MJ/ ft^2/yr. * 100,000 ft^2) and Apartment buildings with annual consumption greater than 6,500 GJ/yr. (~65 MJ/ft^2/yr. * 100,000 ft^2) are included in the Large Office, Large Hotel, Large Non-food Retail and Large Apartment sub sectors, respectively.

- **Medium Office, Medium Hotel/Motel, Medium Non-food Retail, Medium Apartment.** For the purposes of this study, Medium Offices, Medium Hotels/Motels and Medium Apartments have been defined as buildings with a floor area less than 100,000 ft^2 and greater than 50,000 ft^2. Medium Non-food Retail buildings have been defined as buildings with a floor area less than 100,000 ft^2 and greater than 25,000 ft^2. Following the methodology outlined above, Office buildings with annual consumption greater than 1,750 GJ/yr. (~35 MJ/ft^2/yr. * 50,000 ft^2), Hotels with annual consumption greater than 3,000 MJ/yr. (~60 MJ/ ft^2/yr. * 50,000 ft^2), Non-food Retail buildings with annual consumption greater than 850 MJ/yr. (~35 MJ/ ft^2/yr. * 25,000 ft^2) and Apartment buildings with annual consumption greater than 3,000 GJ/yr. (~60 MJ/ft^2/yr. * 50,000 ft^2) but below the respective thresholds for "Large" buildings are included in the Medium Office, Medium Hotel/Motel, Medium Non-food Retail and Medium Apartment sub sectors.

- **Large and Medium School**. For the purposes of this study, Large Schools have been defined as having a floor area greater than 50,000 ft^2, while schools with a floor area of 25,000 ft^2 to 50,000 ft^2 are defined as Medium Schools. Following the methodology outlined above, the

[7] Consumption levels for sub sector size classifications vary only moderately between the Lower Mainland, Vancouver Island and Southern Interior regions. Proportionally higher cut-offs were used for the Northern Interior region to reflect higher space heating loads.

relevant annual consumption threshold levels are 1,700 GJ/yr. (~35 MJ/ft^2/yr. * 50,000 ft^2) and 875 GJ/yr. (~35 MJ/ft^2/yr. * 25,000 ft^2).

- The **Small Commercial** sub sector is a mirror image of the sub sectors listed in Exhibit 2, except that the buildings in this grouping have, on average, less than 25,000 ft^2 of floor space. This sub sector includes buildings which fall below the “Medium” consumption thresholds described above, and any other buildings with consumption of less than 750 GJ/yr. (~30 MJ/ft^2/yr. * 25,000 ft^2). This approach is consistent with the 2006 CPR as well as the 2007 BC Hydro CPR. The rationale is that the annual energy expenditures of medium and large buildings are large enough to support targeted DSM efforts. On the other hand, it was expected that DSM approaches to the smaller buildings (with smaller annual energy expenditures) would rely more heavily on mass market approaches. This rationale also applies to the current study.

- The **Restaurant** sub sector is the one exception to the above methodology. Because restaurants tend to be small buildings with very intensive energy use, all customers identified as restaurants are included in the Restaurant sub sector, regardless of annual consumption.

- The **Recreation and Other** sub sector consists of commercial and institutional buildings that do not fall into one of the primary building types. Examples include: recreational facilities, police and fire stations, airports and bus stations, and provincial and municipal transportation garages. While energy use can be significant in individual buildings within these types, they present one of the following conditions that preclude their inclusion as a sub sector to be modelled individually:

  - The total floor area represented by the individual building type was too small relative to the other primary sub sectors,[8] and/or
  - The energy-use patterns within the building type were too varied to allow a realistic depiction of “typical” energy-use patterns.

Building archetype models were not constructed for the Small Commercial or the Recreational Facilities and Other Buildings sub sectors. Instead, energy consumption apportioned to these sub sectors was carried as an aggregate, and potential savings for these sub sectors was estimated based on the results for the sub sectors for which detailed building archetypes have been produced. This approach is consistent with previous studies.

[8] For example, energy use within a recreational building can be significant; however in the 2007 BC Hydro CPR, when the total electricity use within all recreational facilities was combined, it represented less than 1% of total Commercial sector electricity use.

3.2 Segmentation of FortisBC Sales Data

Once agreement was reached on the selection and definition of the Commercial[9] sub sectors shown in Exhibit 2, FortisBC provided monthly sales data, by account, for the 2009 calendar year. Marbek, in consultation with FortisBC personnel, then grouped this data into sub sectors, using North American Industry Classification System (NAICS) codes and account names in the sorting process.[10] Finally, the 2009 sales data allocated to each sub sector were grossed up to align with the estimated 2010 sales levels contained in FortisBC's most recent load forecast.

Exhibit 3 provides a summary of the allocation of rate-based customer sales data into the sub sectors employed in this CPR. The sales data by sub sector provides the reference point for the calibration of the modelled results that are developed in subsequent steps of the analysis. This data was further disaggregated into its base and weather-sensitive components to assist in the calibration. Base load factors for each sub sector were derived from FortisBC sales data, the previously cited CEUS studies, and Marbek's in-house database of end-use intensities for similar building types and service regions.

[9] Note that this study classifies "Commercial" and "Industrial" facilities based on building/plant attributes, as represented by NAICS codes. This approach, which is consistent with CPR best practices throughout North America, is in contrast with the rate class approach employed by FortisBC. The rate-based approach tends to classify customers based on annual sales volumes. For example, light manufacturing facilities are typically included within FortisBC's small commercial rate class; however, in this study these customers are included in the Industrial sector.

[10] Due to data limitations, sales data for the Whistler service region are not disaggregated by sub sector and include all non-residential sales.

Exhibit 3 Allocation of FortisBC Rate Based Sales Data, by Sector (GJ, 2009)

Vancouver Island	Total (GJ)	Residential	Commercial	Industrial	Residential	Commercial	Industrial
1	4,728,089	4,728,089			100 %	-	-
2	3,482,532		3,310,782	171,750	-	95 %	5 %
3	3,528,982		2,958,271	570,711	-	84 %	16 %
ILF**	201,394				-	-	-
HLF**	540,072				-	-	-
Region Totals	12,481,069	4,728,089	6,269,053	742,461			
Lower Mainland	**Total (GJ)**	**Residential**	**Commercial**	**Industrial**	**Residential**	**Commercial**	**Industrial**
1	52,557,660	52,557,660			100 %	-	-
2	17,269,108		15,227,496	2,041,612	-	88 %	12 %
3	13,426,145		11,514,646	1,911,500	-	86 %	14 %
23	5,172,618		3,931,499	1,241,119	-	76 %	24 %
5	2,230,796		2,009,676	221,120	-	90 %	10 %
7	2,879			2,879	-	-	100 %
22	11,342,960		1,731,694	9,611,266	-	15 %	85 %
25	9,161,290		4,283,674	4,877,616	-	47 %	53 %
27	4,991,397		1,431,315	3,560,082	-	29 %	71 %
Region Totals	116,154,852	52,557,660	40,129,999	23,467,193			
Northern Interior	**Total (GJ)**	**Residential**	**Commercial**	**Industrial**	**Residential**	**Commercial**	**Industrial**
1	8,572,976	8,572,976			100 %	-	-
2	2,840,257		2,568,113	272,144	-	90 %	10 %
3	1,368,728		972,018	396,710	-	71 %	29 %
23	543,381		397,977	145,404	-	73 %	27 %
5	322,090		245,908	76,182	-	76 %	24 %
7	3,832			3,832	-	-	100 %
22	10,793,252			10,793,252	-	-	100 %
25	2,078,529		304,897	1,773,632	-	15 %	85 %
27	617,402		175,218	442,184	-	28 %	72 %
Region Totals	27,140,447	8,572,976	4,664,130	13,903,341			
Southern Interior	**Total (GJ)**	**Residential**	**Commercial**	**Industrial**	**Residential**	**Commercial**	**Industrial**
1	9,095,338	9,095,338			100 %	-	-
2	3,624,807		3,264,320	360,487	-	90 %	10 %
3	1,515,599		1,251,605	263,994	-	83 %	17 %
23	658,292		502,491	155,801	-	76 %	24 %
5	141,034		120,134	20,900	-	85 %	15 %
22	5,371,814			5,371,814	-	-	100 %
25	1,839,891		528,418	1,311,473	-	29 %	71 %
27	246,097			246,097	-	-	100 %
Region Totals	22,492,871	9,095,338	5,666,967	7,730,566			
Whistler	**Total (GJ)**	**Residential**	**Commercial**	**Industrial**	**Residential**	**Commercial**	**Industrial**
1	187,650	187,650			100 %	-	-
2	80,324		80,324		-	100 %	-
3	167,433		167,433		-	100 %	-
Region Totals	435,407	187,650	247,757				
Grand Total	**Total (GJ)**	**Residential**	**Commercial**	**Industrial**	**Residential**	**Commercial**	**Industrial**
1	75,141,713	75,141,713	-	-	100 %	-	-
2	27,297,028	-	24,451,034	2,845,993	-	90 %	10 %
3	20,006,888	-	16,863,973	3,142,915	-	84 %	16 %
23	6,374,291	-	4,831,966	1,542,325	-	76 %	24 %
5	2,693,919	-	2,375,717	318,202	-	88 %	12 %
7	6,711	-	-	6,711	-	-	100 %
22	27,508,026	-	1,731,694	25,776,332	-	6 %	94 %
25	13,079,710	-	5,116,989	7,962,721	-	39 %	61 %
27	5,854,895	-	1,606,533	4,248,363	-	27 %	73 %
ILF	201,394	-	-	-	-	-	-
HLF	540,072	-	-	-	-	-	-
Total	**178,164,575**	**75,141,713**	**56,977,907**	**45,843,561**	**42 %**	**32 %**	**26 %**

****Outside study scope.**

3.3 Natural Gas End Uses

Natural gas use within each of the sub sectors noted above is defined on the basis of specific end uses. In this study, an end use is defined as, "the final application or final use to which energy is applied. End uses are the services of economic value to the users of energy."

A summary of the major Commercial sector end uses used in this study is provided in Exhibit 4, together with a brief description of each.

Exhibit 4 Commercial Sector Natural Gas End Uses

End Use	Description/Comments
Space Heating	Boilers, rooftop units, furnaces,
Water Heating (DHW)	DHW boilers, tank heaters
Cooking Equipment	Food preparation equipment including ranges, broilers, ovens
Other	Pool heating, fireplaces, absorption cooling, sterilizing, etc.

3.4 Fuel Share Data

Space heating and water heating fuel shares developed for the 2006 CPR were used as a starting point for this study. Fuel shares were adjusted based on, among other sources, the results of the 2007 BC Hydro CPR, and results from FortisBC's CEUS (a deliverable of the current project).

A summary of the fuel share data for each end use and modelled sub sector is provided for the Lower Mainland region in Exhibit 5. Data for the remaining service regions is provided in Appendix A.

Exhibit 5 Natural Gas Fuel Share Distribution by Sub Sector and Major End Use for the Lower Mainland Service Region – Existing Buildings (% of total floor space)

Sub Sector	Space Heating	DHW
Large Office	95%	60%
Medium Office	90%	60%
Large Non-food Retail	90%	50%
Medium Non-food Retail	89%	45%
Food Retail	90%	65%
Large Hotel	85%	90%
Medium Hotel	60%	70%
Hospital	95%	90%
Nursing Home	90%	70%
Large School	94%	70%
Medium School	94%	70%
University/College	95%	85%
Restaurant	87%	60%
Warehouse/Wholesale	88%	50%
Large Apartment	85%	75%
Medium Apartment	80%	70%

3.5 Detailed Technical Profiles for Existing Buildings

The next step involved developing building profiles for each of the major existing Commercial sub sectors described above.[11] Each profile contains detailed technical data on building construction and operation, and specifications for gas-fired space heating, DHW, and cooking equipment. These building profiles also include data on relevant electrical equipment such as ventilation equipment, lighting fixtures, and plug and miscellaneous loads. The detailed technical profiles summarize the major data inputs that are used to populate CEEAM models in order to generate a bottom-up profile of energy use in the targeted segments.

The starting point for each profile was the corresponding building profile developed for the previous CPRs. These profiles were developed based on an exhaustive review of B.C. commercial building audit data, consultations with the B.C. engineering and energy retrofit community, as well as with B.C. building design practitioners. The profiles constructed for the current study incorporate recent information describing the B.C. commercial building stock. These include early results from both the CEUS and Commercial sector conditional demand analysis undertaken as part of the current CPR, as well as results of BC Hydro’s most recent Commercial End Use Study. Compared to the profiles used in the 2006 CPR, the net impact of the updates made to the building profiles is an increase in “base load” (non-heating) gas consumption, especially for domestic hot water heating.

Separate building profiles were developed for each combination of sub sector and region. The service regions[12] and the weather data used in this study are noted below:

- The Lower Mainland region (using Vancouver weather data)
- The Vancouver Island region (using Victoria weather data)
- The Northern Interior region (using Prince George weather data)
- The Southern Interior service region (using Summerland weather data).

A sample building profile summary for existing Large Offices in the Lower Mainland is presented in Exhibit 6. Detailed assumptions included in the building profiles are addressed in the following sections.

Detailed profiles for each existing building sub sector are provided in Appendix A.

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[11] Detailed profiles were not constructed for the Small Commercial or Recreation and Other sub sectors. As described above, these sub sectors are carried throughout the study in aggregate. In subsequent stages of analysis, potential savings for the facilities included in these sub sectors are estimated based on the results from the modelled sub sectors

[12] Although the Commercial sector analysis segments Whistler as a separate service region, the available data for the Commercial sector facilities in Whistler are insufficient to support a more detailed analysis at this time. Consequently, Whistler’s Commercial sector is reported at an aggregate level only.

Exhibit 6 Sample Building Profile Summary – Existing Large Office: Lower Mainland

Building Type: Large Office **Location:** Lower Mainland

Description:
This is an archetype of a Large Office building. The inputs used to develop this model include Marbek's Building Energy Performance Database, Terasen's Commercial End Use Study, consultation with engineering practitioners and information gathered as part of market share surveys in various jurisdictions

The Average Building:
The average building characteristics used to define this building profile are as follows:
- Average gross floor area of 21,365 m² (approx 230,000 ft²)
- Average footprint of 1,526 m² (approx 16,500 ft²)
- Average height of 14 stories

Building Envelope:

Roof U Value	0.61 W/m².°C
Wall U Value	0.91 W/m².°C
Window U Value	4.29 W/m².°C
Shading Coefficient (SC)	0.58
Window to Wall Ratio (WWR)	0.41

Space Heating Load 228 MJ/m².yr. P. Design 33.9 W/m²

System Types

Natural Gas						Electric	
Boilers			Forced Air				
Stan.	High	Cond.	RTU	Furnace	Unit Heater		
65%	15%	5%	10%	0%	0%	5%	100%

Water Heating Load 40 MJ/m².yr.

System Types

Natural Gas				Electric	
Std. Tank	Cond. Tank	Std. Boiler	Cnd. Boiler	Tank	
40%	0%	20%	0%	40%	100%

Cooking Load 13 MJ/m².yr

System Types

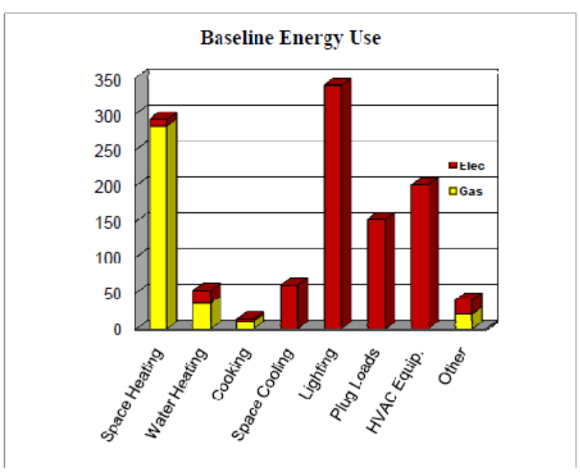
Gas	Electric	
77%	23%	100%

Space Cooling Load 90 MJ/m².yr

System Types

Natural Gas		Electric					
Absorption	Engine	Std. Cent. Chiller	HE Cent. Chiller	Screw Chillers	Open Recip. Chiller	DX Recip. Chiller	
0%	0%	56%	24%	0%	5%	15%	100%

Incidence of Temperature Setback	25%	
Incidence of Ventilation System Shutdown	50%	
Minimum OA	0.78 L/s.m²	0.15 CFM/ft²



Energy Performance Summary

Natural Gas End Use	MJ/m².yr.	m³/m².yr.
Space Heating	283	7.5
Water Heating	35	0.9
Cooking	10	0.3
Space Cooling	0	0.0
Other	20	0.5
Subtotal	348	9.3
Electrical End Use	MJ/m².yr.	
Lighting	339	
Plug Loads & Office Equipment	152	
HVAC Fans and Pumps	200	
Space Heating	9	
Space Cooling	60	
Water Heating	18	
Cooking	3	
Other	19	
Subtotal	801	
Total	**1149**	

3.5.1 *Space Heating Equipment*

Model assumptions related to the distribution of natural gas space heating equipment by type[13] are summarized in Exhibit 7 for the Lower Mainland. Data for the remaining service regions is presented in Appendix A.

Exhibit 7 Natural Gas Space Heating Equipment Distribution for the Lower Mainland Region – Existing Buildings (% of Natural Gas Heated Floor Area)

	Lower Mainland		
Sub Sector	Boiler	Rooftop Unit	Other
Large Office	89%	11%	0%
Medium Office	50%	50%	0%
Large Non-food Retail	22%	67%	11%
Medium Non-food Retail	10%	62%	28%
Food Retail	10%	62%	28%
Large Hotel	79%	21%	0%
Medium Hotel	50%	50%	0%
Hospital	89%	11%	0%
Nursing Home	83%	11%	6%
Large School	77%	11%	13%
Medium School	77%	11%	13%
University/College	89%	11%	0%
Restaurant	5%	55%	40%
Warehouse/Wholesale	9%	40%	51%
Large Apartment	71%	24%	6%
Medium Apartment	56%	25%	19%

3.5.2 *Domestic Hot Water*

Exhibit 8 lists the Base Year distribution of DHW equipment between boilers and tank heaters that has been assumed in this study for all service regions. The distributions are shown by sub sector; data was not available to further differentiate by service region.

Exhibit 8 Natural Gas DHW Equipment Distribution in Total FortisBC Service Area – Existing Buildings (% of Natural Gas DHW- Serviced Floor Area)

Sub Sector	Boiler	Tank
Large Office	33%	67%
Medium Office	17%	83%
Large Non-food Retail	30%	70%
Medium Non-food Retail	22%	78%
Food Retail	8%	92%
Large Hotel	78%	22%
Medium Hotel	43%	57%

[13] "Other" gas space heating equipment includes residential-style forced air furnaces, forced air unit heaters and radiant gas space heating equipment.

Sub Sector	Boiler	Tank
Hospital	89%	11%
Nursing Home	86%	14%
Large School	36%	64%
Medium School	36%	64%
University/College	88%	12%
Restaurant	50%	50%
Warehouse/Wholesale	6%	94%
Large Apartment	67%	33%
Medium Apartment	29%	71%

3.5.3 *Natural Gas Cooking*

Detailed data are not available on the distribution of electric versus natural gas cooking equipment. Instead, the natural gas cooking energy-use intensities (EUIs) used in this study are presented in Exhibit 9. The distributions are shown by sub sector; data were not available to further differentiate by service region. These EUIs represent stock averages that take into account the incidence of gas cooking equipment in each sub sector. These EUIs were developed using Marbek's internal database, which includes the results of CPR studies in several Canadian jurisdictions, as well as the results of recent building audits in all Commercial sub sectors.

Exhibit 9 Natural Gas Cooking EUIs – Existing Buildings (MJ/m^2/yr.)

Sub Sector	EUI (MJ/m^2/yr)
Large Office	10
Medium Office	10
Large Non-food Retail	10
Medium Non-food Retail	20
Food Retail	80
Large Hotel	100
Medium Hotel	60
Hospital	70
Nursing Home	60
Large School	20
Medium School	10
University/College	40
Restaurant	900
Warehouse/Wholesale	5
Large Apartment	10
Medium Apartment	5

3.5.4 Other Gas Use

Natural gas use is used primarily for space heating, hot water heating, and cooking. Other natural gas uses commonly found in commercial buildings include:

- Dehumidification
- Air reheat
- Steam distribution losses
- Sterilizers and other process loads
- Laboratory equipment
- Laundry equipment
- Fireplaces and patio heaters
- Pool heating
- Absorption chillers for space cooling.

Exhibit 10 presents the estimated EUIs for "other" gas uses, and their approximate percentages of the total natural gas use in each sub sector and service region. These EUIs were derived based on Marbek's in-house database, including several building end-use surveys. The values shown in Exhibit 10 are assumed to be applicable in all service regions.

Exhibit 10 Natural Gas EUIs and Percent of Sub Sector Natural Gas Used by "Other" End Uses – Existing Buildings

Sub Sector	EUI (MJ/m^2/yr)	% of Sub Sector Natural Gas Use
Large Office	20	6%
Medium Office	20	5%
Large Non-food Retail	5	1%
Medium Non-food Retail	10	3%
Food Retail	20	4%
Large Hotel	60	8%
Medium Hotel	60	9%
Hospital	250	17%
Nursing Home	70	10%
Large School	5	1%
Medium School	5	1%
University/College	70	13%
Restaurant	20	1%
Warehouse/Wholesale	20	7%
Large Apartment	40	6%
Medium Apartment	30	5%

3.6 Floor Area Calculations

The estimated floor area for each building sub sector was estimated by dividing the FortisBC sales data by the whole building natural gas EUI that was generated by the CEEAM model using the input assumptions, as summarized in the preceding discussions. The general equation is shown below.

$$Floor\,area = \frac{Consumption}{(EUI_{heat})(FS_{heat}) + (EUI_{water\ htg})(FS_{water\,htg}) + (EUI_{cook}) + (EUI_{other})}$$

Where;

EUI is energy-use intensity in MJ/m²/yr.
FS is percent natural gas fuel share for the end use

Exhibit 11 shows the resulting estimates of floor area within each of the modelled sub sectors for FortisBC customers[14] in the Lower Mainland region as well as in the total FortisBC service area. Data for the remaining regions is presented in Appendix A.

Exhibit 11 Base Year Floor Area for Lower Mainland and Total FortisBC Service Area (m^2)

Sub Sector	Lower Mainland	Total FortisBC Service Area
Large Office	2,853,587	4,158,868
Medium Office	1,482,179	2,210,047
Large Non-food Retail	3,380,852	4,055,816
Medium Non-food Retail	1,997,727	2,520,528
Food Retail	476,237	923,369
Large Hotel	724,240	1,153,115
Medium Hotel	387,211	710,255
Hospital	1,302,501	2,042,883
Nursing Home	1,262,027	1,909,287
Large School	2,857,352	4,117,587
Medium School	1,602,266	2,685,613
University/College	3,869,828	4,868,608
Restaurant	1,740,290	2,324,101
Warehouse/Wholesale	598,670	816,519
Large Apartment	15,421,251	16,633,453
Medium Apartment	9,147,687	10,142,849
Total	49,103,905	61,272,899
%	80%	100%

[14] This approach differs slightly from the 2006 CPR, which estimated the floor space for all B.C. commercial facilities, regardless of whether they were FortisBC (then Terasen Gas) customers. The approach employed in the 2006 CPR was intended to facilitate the analysis of fuel switching options. Fuel switching is not part of the scope of this study; consequently, it was decided to narrow the focus to only FortisBC customers.

3.7 Base Year Commercial Natural Gas Use

This section presents the Base Year Commercial sector results.

Exhibit 12 provides a summary of Base Year (2010) Commercial sector natural gas consumption by sub sector and end use for the total FortisBC service area.[15]

[15] The pie charts in Exhibit 12 and Exhibit 13 show distribution of gas consumption by end use, based on the modelled sub sectors. As is the case throughout this report, the sub sectors Small Commercial, Recreation Facilities and Other have not been modelled at the same level of end-use detail due to data constraints. In the absence of better data, the % distributions from the modelled sub sectors have been assumed for the non-modelled sub sectors.

Exhibit 12 Base Year (2010) Natural Gas Consumption by Sub Sector and End Use for the Total FortisBC Service Area 2010 (GJ/yr.)

Sub Sector	Commercial Cooking	Domestic Hot Water	Space Heating	Other	Grand Total
Large Office	41,589	146,068	1,250,960	83,177	1,521,793
Medium Office	22,100	69,616	782,651	44,201	918,569
Large Non-food Retail	40,558	104,378	1,249,447	20,279	1,414,662
Medium Non-food Retail	50,411	59,055	819,613	25,205	954,284
Food Retail	73,870	63,880	341,118	18,467	497,335
Large Hotel	115,311	337,389	362,190	69,187	884,077
Medium Hotel	42,615	169,779	219,372	42,615	474,382
Hospital	143,002	586,786	2,001,013	510,721	3,241,521
Nursing Home	114,557	317,906	781,546	133,650	1,347,659
Large School	82,352	168,135	1,237,559	20,588	1,508,633
Medium School	26,856	109,663	1,058,248	13,428	1,208,195
University/College	194,744	364,370	1,841,340	340,803	2,741,257
Restaurant	2,091,691	1,195,252	1,220,606	46,482	4,554,031
Warehouse/Wholesale	4,083	15,559	199,839	16,330	235,810
Large Apartment	166,335	3,481,420	4,728,026	665,338	9,041,119
Medium Apartment	50,714	1,883,367	2,775,717	304,285	5,014,084
Small Commercial	-	-	-	-	16,815,434
Recreation and Other	-	-	-	-	4,357,305
Whistler	-	-	-	-	247,757
Grand Total	3,260,788	9,072,621	20,869,245	2,354,758	56,977,907

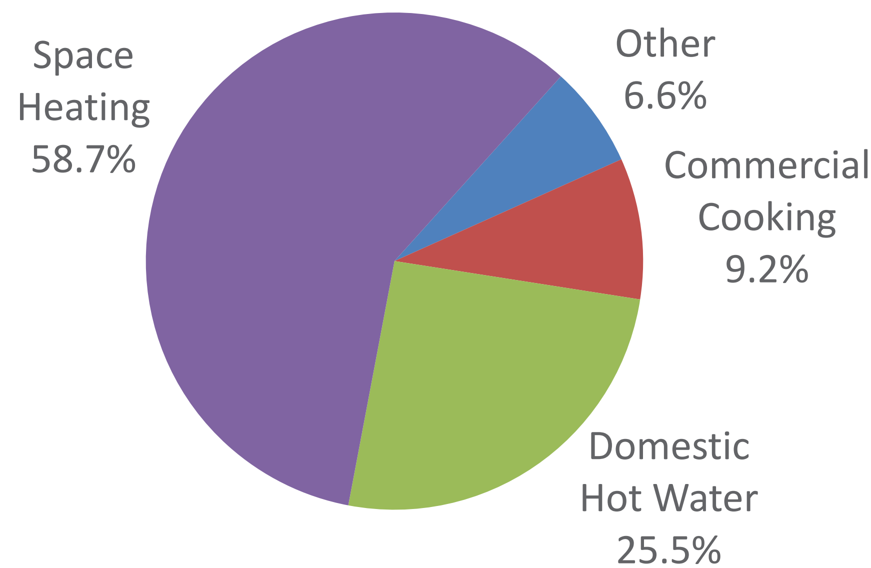
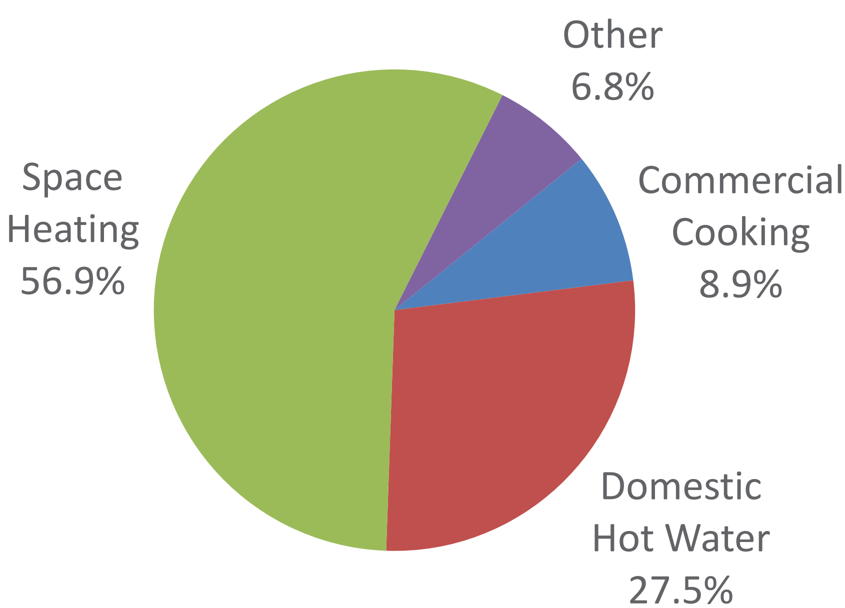


Exhibit 13 presents the Base Year (2010) Commercial sector natural gas consumption by sub sector and end use for the Lower Mainland region.

Exhibit 13 Base Year Natural Gas Consumption by Sub Sector and End Use for the Lower Mainland, 2010 (GJ/yr.)

Row Labels	Commercial Cooking	Domestic Hot Water	Space Heating	Other	Grand Total
Large Office	28,536	100,224	807,250	57,072	993,081
Medium Office	14,822	46,689	483,028	29,644	574,182
Large Non-food Retail	33,809	87,007	993,155	16,904	1,130,875
Medium Non-food Retail	39,955	46,806	617,067	19,977	723,805
Food Retail	38,099	32,947	171,879	9,525	252,450
Large Hotel	72,424	211,905	212,794	43,454	540,577
Medium Hotel	23,233	92,559	105,742	23,233	244,766
Hospital	91,175	374,123	1,115,804	325,625	1,906,727
Nursing Home	75,722	210,134	477,778	88,342	851,976
Large School	57,147	116,675	797,202	14,287	985,311
Medium School	16,023	65,426	581,843	8,011	671,303
University/College	154,793	289,620	1,358,135	270,888	2,073,437
Restaurant	1,566,261	895,006	861,685	34,806	3,357,759
Warehouse/Wholesale	2,993	11,408	133,450	11,973	159,825
Large Apartment	154,213	3,227,704	4,328,438	616,850	8,327,204
Medium Apartment	45,738	1,698,581	2,459,843	274,431	4,478,593
Small Commercial	-	-	-	-	10,381,028
Other	-	-	-	-	2,477,102
Grand Total	2,414,941	7,506,812	15,505,094	1,845,022	40,129,999



Additional results for the remaining service regions are provided in Appendix A.

Selected highlights are provided below.

By Sub Sector

- Within the Commercial sector, Small Commercial buildings account for 30% of gas consumption across the FortisBC service area. Although each individual customer included within this sub sector is a small natural gas user, the sub sector includes a very large number of customers, resulting in this large portion of overall consumption.
- Apartment buildings account for a further 25% of consumption within the entire service area. Approximately two-thirds of this consumption occurs in Large Apartment buildings.
- Other high-consuming sub sectors include Restaurant (8%), Hospital (6%), University/College (5%), Office (5%), and Non-food Retail (4%). The un-modelled sub sector Recreation Facilities and Other accounts for approximately 8% of total gas consumption.

By End Use

- Space heating (59%) accounts for the largest share of natural gas consumption in all service regions and sub sectors. The space heating share of total Commercial sector consumption varies by climate, accounting for 61% of total gas use in the Vancouver Island Region, 63% in the Southern Interior Region and 74% in the Northern Interior Region.
- DHW (25%) is the second largest end use within the Commercial sector across all service regions. This is significantly higher than the 2006 CPR, primarily as a result of the inclusion of apartment buildings in the Commercial sector in the current study, but also in part as a result of the findings of the CEUS. The DHW share of total Commercial sector consumption is 21% in the Vancouver Island Region, 20% in the Southern Interior Region and 13% in the Northern Interior Region.
- Commercial cooking (9%) and Other (7%) account for the remaining Commercial sector natural gas use within the total FortisBC service area.

Exhibit 13 presents the Base Year (2010) Commercial sector natural gas consumption by sub sector and end use for the Lower Mainland region.

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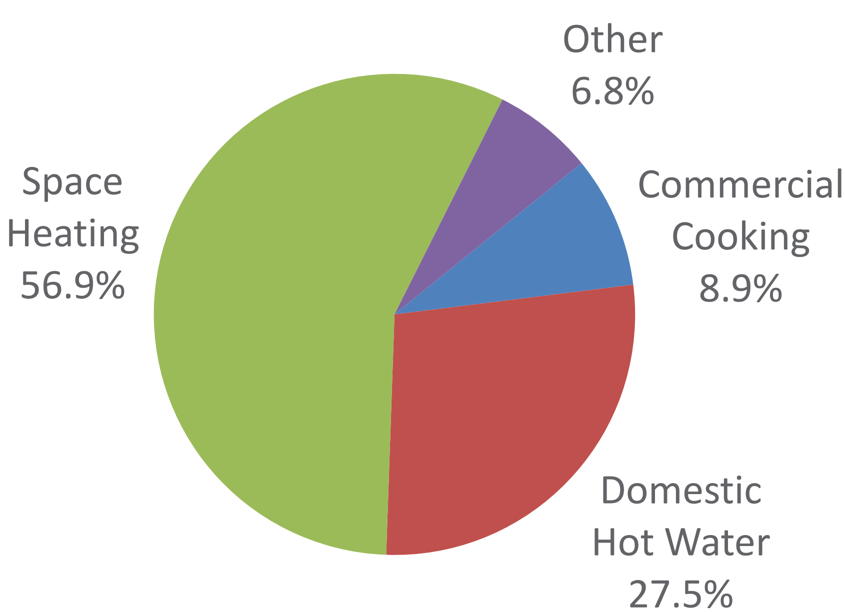

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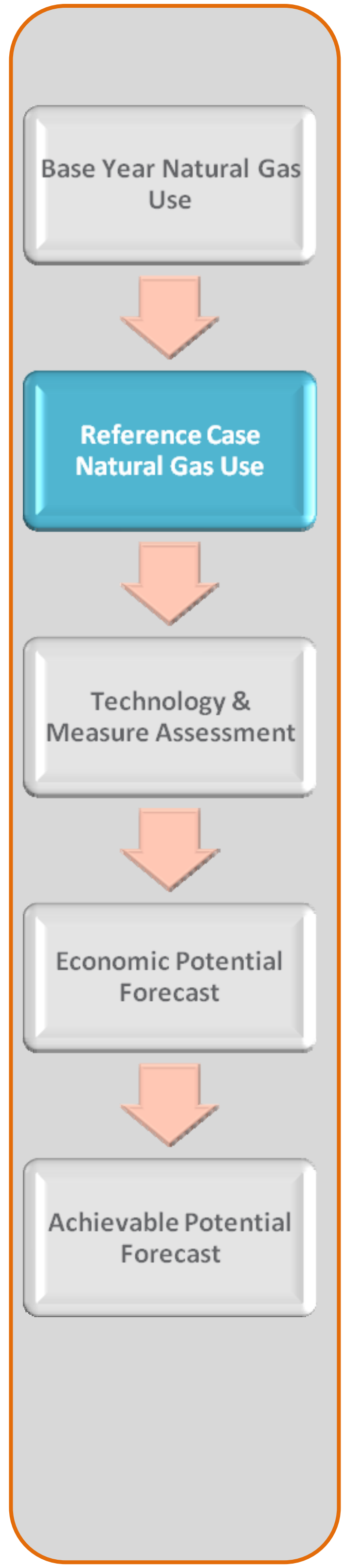
- Commercial cooking (9%) and Other (7%) account for the remaining Commercial sector natural gas use within the total FortisBC service area.

4 Reference Case Natural Gas Forecast



4.1 Introduction

This section presents the Commercial sector Reference Case for the study period (2010 to 2030). The Reference Case estimates the expected level of natural gas consumption that would occur over the study period in the absence of new utility-based DSM initiatives.

The Reference Case includes the ongoing effects of DSM activity initiated before the study period, and also includes the effects of DSM activity by other actors in the market, such as BC Hydro. The Reference Case also presents a scenario in which policy, legislation, and regulation continue to exist as they are today. Legislation that is not yet passed or clearly mapped out is subject to influence by FortisBC and is therefore considered within the realm of potential savings.

The Reference Case, therefore, provides the point of comparison for the calculation of energy saving opportunities associated with each of the scenarios that are assessed within this study.

The discussion is presented within the following sub sections:

- Methodology
- Summary of Model Results.

4.2 Methodology

Development of the Reference Case involved the following steps:

- **Step 1**: The detailed profiles of new commercial buildings (those buildings expected to be constructed during the study period) were updated for each sub sector in each service region. Changes in building envelope and equipment affecting energy consumption were noted.

- **Step 2:** The growth in commercial building floor space was estimated for each sub sector within each service region.

- **Step 3**: Naturally-occurring[16] efficiency changes affecting annual natural gas use in existing buildings were estimated. Special consideration was given to three factors:

  - Naturally-occurring improvements in equipment efficiency
  - Expected penetration of more efficient equipment into the building stock
  - Known, upcoming changes in building and equipment energy performance codes and standards.[17]

[16] Naturally-occurring changes are meant to include any changes that are not the result of FortisBC DSM initiatives.

- **Step 4**: Changes in natural gas share for each end use were estimated.
- **Step 5:** The inputs from the preceding steps were entered into the Commercial sector model and estimates of natural gas use throughout the study period were generated.

A brief description of the tasks involved in the completion of the above steps is provided below. Additional discussion of the methodology employed is provided in Appendix B.

4.2.1 Development of Detailed Profiles—New Buildings

The first task in building the Reference Case involved the development of detailed technical profiles that define building specifications, mechanical equipment, cooking, and miscellaneous equipment for the "new" buildings in each of the Commercial sub sectors. In each case, the new building profiles were developed using Marbek's building energy simulation model, CEEAM, and the same approach as described previously in the Base Year discussion.

A sample building profile summary for new Large Offices in the Lower Mainland is presented in Exhibit 14. It summarizes the major technical assumptions that have been used for new offices in the development of the Reference Case.

A complete set of detailed profiles for new buildings is presented in Appendix B.

[17] The anticipated effects of any code/standard changes, which have been passed into law, are included in the Reference Case. Effects of changes due to codes/standards currently in development (for example, the 2011 National Energy Code for Buildings) are not included.

Exhibit 14 Sample New Building Profile Summary – New Large Office in Lower Mainland

Building Type:	Large Office	**Location:**	Lower Mainland

Description:
This is an archetype of a Large Office building. The inputs used to develop this model include Marbek's Building Energy Performance Database, Terasen's Commercial End Use Study, consultation with engineering practitioners and information gathered as part of market share surveys in various jurisdictions.

The Average Building:
The average building characteristics used to define this building profile are as follows:
- Average gross floor area of 21,365 m² (approx 230,000 ft²)
- Average footprint of 1,526 m² (approx 16,500 ft²)
- Average height of 14 stories

Building Envelope:

Roof U Value	0.34 W/m².°C
Wall U Value	0.88 W/m².°C
Window U Value	3.50 W/m².°C
Shading Coefficient (SC)	0.40
Window to Wall Ratio (WWR)	0.60

Space Heating — Load 228 MJ/m².yr. — P. Design 33.9 W/m²

System Types	Natural Gas						Electric	
	Boilers			Forced Air				
	Stan.	High	Cond.	RTU	Furnace	Unit Heater		
	35%	35%	15%	10%	0%	0%	5%	100%

Water Heating — Load 35 MJ/m².yr.

System Types	Natural Gas				Electric	
	Std. Tank	Cond. Tank	Std. Boiler	Cnd. Boiler	Tank	
	40%	0%	30%	0%	30%	100%

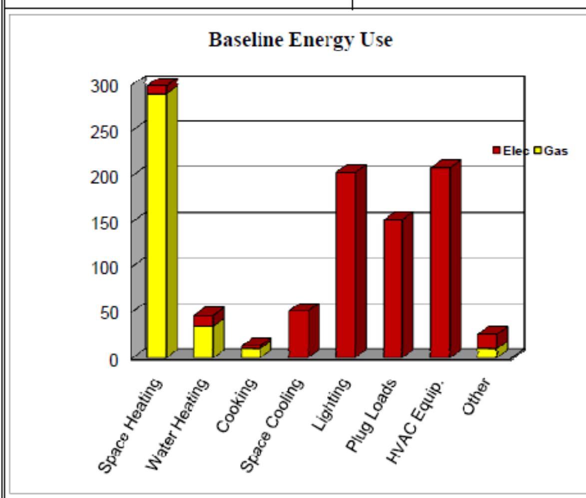
Cooking — Load 13 MJ/m².yr

System Types	Gas	Electric	
	77%	23%	100%

Space Cooling — Load 84 MJ/m².yr

System Types	Natural Gas		Electric					
	Absorption	Engine	Std. Cent. Chiller	HE Cent. Chiller	Screw Chillers	Open Recip. Chiller	DX Recip Chiller	
	0%	0%	0%	70%	20%	5%	5%	100%

Incidence of Temperature Setback	25%	
Incidence of Ventilation System Shutdown	50%	
Minimum OA	0.85 L/s.m²	0.15 CFM/ft²



Energy Performance Summary

Natural Gas End Use	**MJ/m².yr.**	**m³/m².yr.**
Space Heating	290	7.7
Water Heating	34	0.9
Cooking	10	0.3
Space Cooling	0	0.0
Other	10	0.3
Subtotal	344	9.1
Electrical End Use	**MJ/m².yr.**	
Lighting	203	
Plug Loads & Office Equipment	152	
HVAC Fans and Pumps	208	
Space Heating	9	
Space Cooling	51	
Water Heating	12	
Cooking	3	
Other	16	
Subtotal	653	
Total	997	

Exhibit 15 highlights the resulting whole building natural gas EUIs for new buildings in each Commercial sub sector for the Lower Mainland. With a few noted exceptions, whole building EUIs are lower for new[18] buildings compared to existing buildings. General factors that lead to lower gas energy intensity for new buildings include the following:

- Improved thermal characteristics of building envelope systems including walls, roofs and windows
- Higher efficiency heating systems
- Higher efficiency water heating systems.

There are also several factors that contribute to higher gas energy intensities in new buildings, including:

- Higher ventilation rates, which lead to an increase in space heating energy. This is especially relevant in new institutional buildings such as Hospitals and Nursing Homes where a large portion of the heating energy reductions achieved through improved building envelopes and high-efficiency heating systems are offset by increased ventilation rates
- Higher gas shares for space heating and water heating in new buildings belonging to FortisBC customers
- Lower internal heat gains due to improved lighting efficiencies.

[18] New buildings include FortisBC Customers only. Buildings added to the Commercial sector stock, that do not become FortisBC customers, are not included in this analysis.

Exhibit 15 Comparison of Existing and New Whole Building Gas EUIs – Lower Mainland (MJ/m²/yr.)

Sub Sector	Existing Buildings	New Buildings	Comments
Large Office	348	328	
Medium Office	387	404	Although building shells are improved in new Medium Office buildings, higher ventilation rates and lower internal heat gains (primarily as a result of a decrease in connected lighting load) result in higher overall heating loads.
Large Non-food Retail	334	173	New Large Non-food Retail buildings tend to be "big box" style buildings with high internal heat gains, low window: wall ratios and low surface area: volume ratios resulting in much lower space heating EUIs
Medium Non-food Retail	362	319	
Food Retail	530	483	
Large Hotel	746	669	
Medium Hotel	632	531	
Hospital	1464	1323	
Nursing Home	675	669	
Large School	345	376	Although building shells are improved in new Schools, higher ventilation rates result in higher overall heating loads.
Medium School	419	360	
University/College	536	518	
Restaurant	1929	2037	Slightly higher overall EUI driven by a higher gas fuel share for DHW
Warehouse/Wholesale	267	272	New Warehouses have a higher gas fuel share for space heating DHW, partially offset by a better performing thermal envelope.
Large Apartment	540	491	
Medium Apartment	490	485	

A comparison of whole building natural gas EUIs for new and existing buildings in the remaining Commercial sub sectors is provided in Appendix B. Refer to building archetype summaries in Appendices B and C for further detail.

4.2.2 *Expected Growth in Commercial Sector Floor Space*

The next step in developing the Reference Case involved the development and application of estimated levels of floor space growth in each sub sector and service region over the study period.

The sub sector floor space growth rates used in this study were developed from the rate-based growth provided by FortisBC's Load Forecasting Group. In each sub sector and service region, total sales growth for each rate class contained in the FortisBC load forecast was allocated to the Commercial sector using the mapping shown previously in Exhibit 3. The resulting total Commercial sector sales growth in each study period and service region was then allocated among individual sub sectors using the same proportions as developed in the 2007 BC Hydro CPR.

Exhibit 16 presents the resulting estimated growth rates for FortisBC customers in the Lower Mainland service region, by sub sector and study milestone period.

Exhibit 16 FortisBC Customer Commercial Floor Space Growth Rates for Lower Mainland by Sub Sector and Study Milestone Period (%/yr.)

Sub Sector	Period 2010-2015 %	2015-2020 %	2020-2025 %	2025-2030 %
Large Office	3.22%	2.76%	2.30%	2.07%
Medium Office	3.22%	2.76%	2.30%	2.07%
Large Non-food Retail	3.83%	3.29%	2.74%	2.46%
Medium Non-food Retail	3.83%	3.29%	2.74%	2.46%
Food Retail	3.53%	3.02%	2.52%	2.27%
Large Hotel	3.68%	3.15%	2.63%	2.37%
Medium Hotel	3.68%	3.15%	2.63%	2.37%
Hospital	2.60%	2.23%	1.86%	1.67%
Nursing Home	3.53%	3.02%	2.52%	2.27%
Large School	3.22%	2.76%	2.30%	2.07%
Medium School	3.22%	2.76%	2.30%	2.07%
University/College	3.22%	2.76%	2.30%	2.07%
Restaurant	3.22%	2.76%	2.30%	2.07%
Warehouse/Wholesale	3.37%	2.89%	2.41%	2.17%
Large Apartment	3.40%	2.90%	2.43%	2.21%
Medium Apartment	3.40%	2.90%	2.43%	2.21%
Small Commercial	4.15%	3.55%	2.96%	2.67%
Recreation Facilities and Other	3.40%	2.90%	2.43%	2.21%

4.2.3 *Natural Changes Affecting Natural Gas Consumption*

The next task involved an estimation of expected “natural” changes in natural gas consumption patterns over the study period with consideration of three major factors:

- Naturally-occurring improvements in equipment efficiency
- Expected penetration of more efficient equipment into the commercial building stock that would occur in the absence of DSM activities
- Impacts of new building and equipment performance standards.

A discussion of the expected natural changes follows. In each case, the discussion identifies the technical change, the major driver(s) and the assumed natural gas impact.

Space Heating

Gas boilers being installed in new buildings are assumed to be a mix of standard, near condensing and condensing boilers. An estimated weighted seasonal efficiency, shown in Exhibit 17, was used in the building profile models. Estimated seasonal efficiency of boilers in the existing building stock is shown for comparison purposes.

The type of space heating equipment installed in new buildings was assumed to be constant through the study period, while modest improvements in the equipment efficiency are assumed in later milestone years.

Exhibit 17 Estimated Stock Weighted, Seasonal Natural Gas Boiler Efficiency in Existing and New Buildings

Sub sector	Existing Boiler Efficiency (%)	New Boiler Efficiency (%)
Large Office	77%	80%
Medium Office	78%	82%
Large Non-food Retail	79%	80%
Medium Non-food Retail	79%	80%
Food Retail	79%	80%
Large Hotel	78%	81%
Medium Hotel	79%	82%
Hospital	79%	80%
Nursing Home	78%	81%
Large School	78%	81%
Medium School	78%	81%
University/College	79%	82%
Restaurant	80%	81%
Warehouse/Wholesale	79%	80%
Large Apartment	78%	82%
Medium Apartment	78%	82%

Domestic Hot Water

The type of DHW equipment installed in new buildings was assumed to be constant through the study period, with modest improvements in equipment efficiency assumed in later milestone years.

Commercial Cooking

Commercial cooking EUIs for new buildings were assumed to be equivalent to those in existing buildings. Very little research has been done on commercial cooking EUIs; the great uncertainty in these numbers precludes predicting either increases or decreases.

Other

The EUI for the Other end use was assumed to be independent of building vintage and was assumed to be constant throughout the study period.

4.2.4 *Electrical End Uses*

Natural changes also occur in the electrical end uses and are incorporated in the CEEAM sub sector models. The two most relevant electrical end uses for this study are:

- Lighting
- Plug loads.

Lighting

The continued replacement of T12 fluorescent lighting and electromagnetic ballasts with T8 fluorescent lamps and electronic ballasts in existing buildings is being driven by decreasing prices, increasing public recognition of the savings, and changing energy performance codes and standards. The Federal government has also announced their commitment to phase out incandescent lighting from the marketplace, beginning in 2012. Both of these lighting changes will result in reduced lighting loads and, hence, reduced internal heat gains. As lighting loads decrease, winter heating loads will tend to increase.

Plug Loads

The density and variety of office and other plug load equipment is increasing. However, the electricity use of many types of office equipment has been decreasing due to programs such as ENERGY STAR®. Previous studies performed on behalf of BC Hydro, Newfoundland Power/Newfoundland and Labrador Hydro and SaskPower have assumed a low to intermediate growth scenario in terms of overall plug load. An increase in plug loads will tend to decrease heating loads via increased internal heat gains.

The net impacts of these electrical trends are included in the results provided in the following sections.

4.2.5 *Additional Considerations*

The B.C. government's aggressive GHG emissions reduction goals have led to the proposal and implementation of a variety of building codes and standards, as well as equipment efficiency regulations that will impact energy consumption in the near and long term. The Reference Case attempts to incorporate the effects of energy performance codes and standards which are currently in effect, but does not include proposed codes, standards or other legislation.

4.3 Summary of Results

This section presents the estimated Commercial sector natural gas consumption for the Reference Case period of 2010 to 2030. The results are summarized in the following exhibits:

- Exhibit 18 presents total Commercial sector Reference Case natural gas consumption by service region and milestone year for the period 2010 to 2030

- Exhibit 19 presents total Commercial sector Reference Case natural gas consumption by sub sector and milestone year for the Total FortisBC Service Area

- Exhibit 20 presents Commercial sector Reference Case natural gas consumption by sub sector and milestone year for the Lower Mainland service region.

Exhibit 18 Commercial Sector Reference Case Forecast by Milestone Year and Service Region for the Total FortisBC Service Area, 2010-2030 (GJ/yr.)

Year	Lower Mainland	Vancouver Island	Southern Interior	Northern Interior	Whistler	Total
2010	40,129,999	6,269,053	5,666,967	4,664,130	247,757	56,977,907
2015	40,948,617	6,779,613	5,992,207	4,886,268	255,476	58,862,181
2020	41,607,601	7,166,802	6,254,569	5,065,860	261,781	60,356,613
2025	42,102,254	7,352,425	6,457,729	5,205,255	266,448	61,384,111
2030	42,518,263	7,501,672	6,631,734	5,325,027	270,465	62,247,161

Exhibit 19 Commercial Sector Reference Case Forecast by Milestone Year and Sub Sector for the Total FortisBC Service Area, 2010-2030 (GJ/yr.) [19]

Sub Sector	2010	2015	2020	2025	2030
Large Office	1,521,793	1,564,932	1,596,020	1,611,824	1,622,704
Medium Office	918,569	947,652	969,109	981,456	990,525
Large Non-food Retail	1,414,662	1,430,614	1,440,258	1,443,315	1,443,293
Medium Non-food Retail	954,284	976,289	992,527	1,002,295	1,009,270
Food Retail	497,335	519,035	535,479	544,725	551,939
Large Hotel	884,077	915,774	940,260	955,773	968,146
Medium Hotel	474,382	490,902	503,640	512,042	518,728
Hospital	3,241,521	3,316,614	3,370,181	3,398,320	3,417,696
Nursing Home	1,347,659	1,396,788	1,434,641	1,459,060	1,478,468
Large School	1,508,633	1,557,142	1,592,943	1,613,148	1,627,968
Medium School	1,208,195	1,242,147	1,266,488	1,279,244	1,287,973
University/College	2,741,257	2,814,974	2,869,667	2,900,968	2,924,065
Restaurant	4,554,031	4,717,165	4,848,104	4,941,055	5,019,529
Warehouse/Wholesale	235,810	242,989	248,284	251,245	253,401
Large Apartment	9,041,119	9,194,678	9,303,507	9,364,447	9,405,948
Medium Apartment	5,014,084	5,119,498	5,196,005	5,240,844	5,273,325
Small Commercial	16,815,434	17,576,268	18,217,816	18,716,067	19,164,489
Recreation Facilities and Other	4,357,305	4,583,246	4,769,902	4,901,833	5,019,227
Grand Total	56,730,150	58,606,705	60,094,833	61,117,662	61,976,695

[19] Exhibit 19 consumption does not include Whistler, as data were not available at this level of disaggregation.

Exhibit 20 Commercial Sector Reference Case Forecast, by Milestone Year and Sub Sector for Lower Mainland, 2010-2030 (GJ/yr.)

Sub Sector	2010	2015	2020	2025	2030
Large Office	993,081	1,003,285	1,009,665	1,011,985	1,012,299
Medium Office	574,182	581,768	586,895	589,411	590,634
Large Non-food Retail	1,130,875	1,129,565	1,125,620	1,118,812	1,110,652
Medium Non-food Retail	723,805	733,459	740,113	743,523	745,338
Food Retail	252,450	256,156	258,869	260,511	261,630
Large Hotel	540,577	550,338	557,935	563,178	567,266
Medium Hotel	244,766	248,519	251,358	253,204	254,563
Hospital	1,906,727	1,920,548	1,928,620	1,930,646	1,929,709
Nursing Home	851,976	867,639	879,632	887,663	893,743
Large School	985,311	999,925	1,010,126	1,015,639	1,018,824
Medium School	671,303	675,685	677,714	677,246	675,550
University/College	2,073,437	2,102,578	2,123,549	2,135,818	2,143,780
Restaurant	3,357,759	3,438,588	3,505,480	3,557,299	3,601,757
Warehouse/Wholesale	159,825	162,100	163,681	164,521	164,993
Large Apartment	8,327,204	8,437,357	8,513,706	8,557,305	8,585,163
Medium Apartment	4,478,593	4,547,766	4,597,030	4,627,018	4,647,706
Small Commercial	10,381,028	10,732,397	11,042,636	11,309,761	11,556,958
Recreation Facilities and Other	2,477,102	2,560,945	2,634,974	2,698,715	2,757,700
Grand Total	40,129,999	40,948,617	41,607,601	42,102,254	42,518,263

Additional results for the remaining service regions are provided in Appendix B.

Selected highlights are provided below.

By Sub Sector

- The sub sectors that account for a larger portion of gas consumption in 2030 compared to 2010 include: Food Retail, Large Hotel, Medium Hotel, Nursing Home, Restaurant, Small Commercial and Recreation/Other.
- The sub sectors that account for a smaller portion of gas consumption in 2030 than in 2010 include: Large Office, Small Office, Large Non-food Retail, Small Non-food Retail, Hospital, Large School, Medium School, University/College, Warehouse/Wholesale, Large Apartment and Medium Apartment.

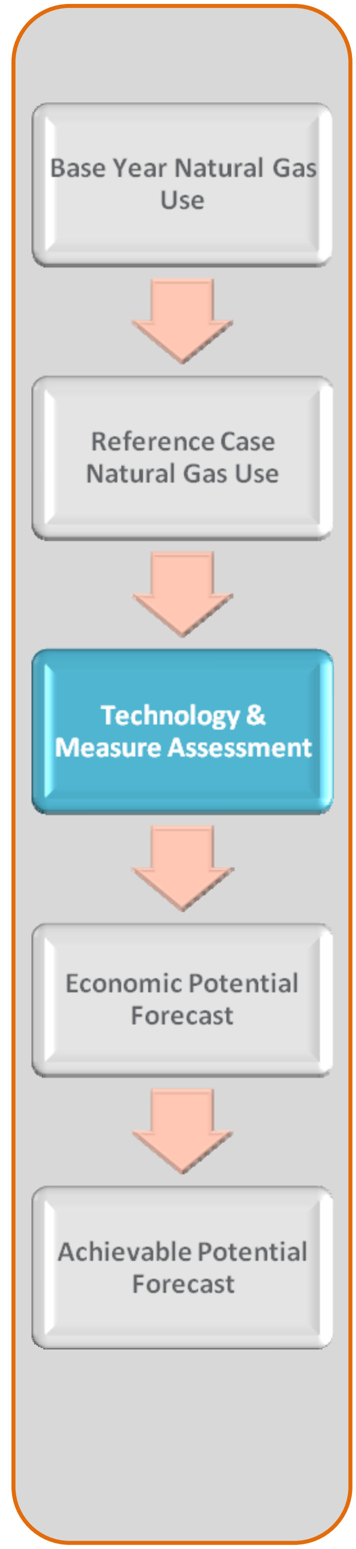
By End Use

- By 2030 space heating is projected to account for a slightly smaller share of gas consumption than in 2010, due to natural improvements in building envelopes and space heating equipment, which are expected to outpace natural improvements in other end uses.[20] In 2030, space heating is projected to account for 58% of total Commercial sector gas consumption across the FortisBC service area (compared to 59% in 2010).

[20] Natural gas space heating shares are assumed to remain constant for existing commercial buildings.

- DHW is expected to continue to be the second largest end use within the FortisBC service area in 2030, holding at 26% of all gas use. Other end uses account for a slightly larger proportion of 2030 gas use than 2010 gas use (17% vs. 16%).

5 Technology & Measure Assessment



5.1 Introduction

This section identifies and assesses the financial and economic attractiveness of the selected energy-efficiency and alternative energy measures for the Commercial sector. The discussion is organized and presented as follows:

- Methodology
- Energy-efficiency and alternative energy technologies
- Summary of results.

5.2 Methodology

The following steps were employed to assess the energy-efficiency and fuel choice measures:

- Select candidate energy-efficiency measures
- Establish technical performance for each option within a range of applicable load sizes and/or service region conditions (e.g., degree days)
- Establish the capital, installation and operating costs for each option
- Calculate the simple payback from the customer’s perspective
- Calculate the measure total resource cost (measure TRC)
- Calculate the benefit-cost ratio.

A brief discussion of each step is outlined below.

Step 1 Select Candidate Measures

The candidate measures were selected in close collaboration with FortisBC based on a combination of a literature review and the previous experience of both the consultants and FortisBC personnel. The selected measures are all considered to be technically proven and commercially available, even if only at an early stage of market entry. Technology costs, which will be addressed in this section, were not a factor in this initial selection of candidate technologies.

Step 2 Establish Technical Performance

Information on the performance improvements provided by each measure was compiled from available secondary sources, including the experience and on-going research work of study team members. As applicable, the energy impacts of the measures are reported for both natural gas and electricity.

Step 3 Establish Capital, Installation and Operating Costs for Each Measure

Information on the cost of implementing each measure was also compiled from secondary sources, including the experience and on-going research work of study team members. As applicable, both the incremental and full cost of each measure were estimated.

The incremental cost is applicable when a measure is installed in a new facility or at the end of its useful life in an existing facility; in this case, incremental cost is defined as the difference between the energy-efficiency or alternative energy option relative to the “baseline” technology. The full cost is applicable when an operating piece of equipment is replaced with a more efficient model or a fuel choice option prior to the end of its useful life.

In both cases, the costs and savings are annualized, based on the number of years of equipment life and the discount rate, and the costs incorporate applicable changes in annual O&M costs. All cost are expressed in constant (2010) dollars.

Step 4 Calculate Simple Payback

The simple payback is generated to show the attractiveness of a measure from the customer’s financial perspective. Simple payback is *“a measure of the length of time required for the cumulative savings from a project to recover its initial investment cost and other accrued costs, without taking into account the time value of money. The simple payback period is usually measured from the service date of the project.”*[21] The cost of the measure (incremental or full, as appropriate) is divided by the expected annual savings. The answer is given in years**.**

The following equation illustrates how this calculation is applied to a situation where an upgrade has a higher upfront cost than the baseline technology, but lower ongoing operating costs:

$$\text{Payback}_{(\text{years})} = (\text{CostUpgr} - \text{CostBase})/(\text{AnnBase} - \text{AnnUpgr})$$

where:

CostUpgr	= initial capital cost of the upgrade measure ($)
CostBase	= initial capital cost of the baseline measure ($)
AnnUpgr	= ongoing operating cost of the upgrade ($/year)
AnnBase	= ongoing operating costs of the baseline technology ($/year)

Step 5 Calculate the Measure Total Resource Cost (TRC)

The measure TRC calculates the net present value of energy savings that result from an investment in an efficiency or fuel choice technology or measure. The measure TRC is equal to its full or incremental capital cost (depending on application) plus any change (positive or negative) in the combined annual energy and O&M costs. This calculation includes, among others, the following inputs: the avoided natural gas and electricity supply costs, the life of the technology, and the selected discount rate, which in this analysis has been set at 7.38% for most of the regions and 6.87% for Vancouver Island.

A technology or measure with a positive TRC value is included in subsequent phases of the analysis, which consists of the Economic and Achievable Potential scenarios. A measure with a

[21] Sieglinde K. Fuller and Stephen R. Petersen. (1996). “*Life Cycle Costing Manual for the Federal Energy Management Program”.* National Institute of Standards and Technology Handbook 135, 1995 Edition, Washington, DC.

negative TRC value is not economically attractive and is therefore not included in subsequent stages of the analysis.

It should be noted that the measure TRC provides an initial screen of the technical options. Considerations such as program delivery costs, incentives, etc., are incorporated in later detailed program design stages, which are beyond the scope of this study.

Step 6 Calculate Benefit-Cost Ratio

The measure benefit-cost ratio indicates the relative attractiveness of the measures. A measure that has a benefit-cost ratio in excess of "1" means that the measure's benefits outweigh its costs; it is, therefore, included in subsequent stages of the analysis. Similarly, a measure with a benefit-cost ratio that is well in excess of one (e.g., 3) means that it is very attractive. A measure with a benefit-cost ratio of less than one means that its costs outweigh its benefits and, hence, is not included in subsequent stages of the analysis.

5.2.1 *Energy Costs*

The financial and economic results that are presented in this section are based on the following

- Avoided supply cost of natural gas
- Avoided supply cost of electricity
- Customer energy prices.

A brief discussion of each is provided below.

Avoided Supply Cost of Natural Gas

Natural gas avoided supply costs were provided by FortisBC[22] and are summarized in Exhibit 21. As illustrated, the avoided cost of gas on a per unit basis includes three components: an estimate of the commodity cost, an estimate of the distribution cost and the carbon tax.

- The commodity cost is based on the 10-year AECO price forecast according to GLJ Petroleum Consultants (an independent energy consultant) based on their latest available forecast (updated by GLJ each quarter).

- The distribution costs are estimated by calculating an approximation of the pipeline transportation charges required by FortisBC to move the commodity supply to core markets as well as the storage costs associated with meeting winter load requirements.

- The carbon tax values shown are based on current estimates of $20/ton, $25/ton for 2011 and then remaining constant at $30/ton from 2011 and beyond.

The resulting avoided costs represent the expected marginal cost of to serve FortisBC's customers on a per unit basis. In this study, no distinction has been made between high load factor (flat) and low load factor (peaky) load shapes, or between different service areas within the province.

[22] FortisBC, Supply Group. Values are updated quarterly.

Exhibit 21 Natural Gas – Avoided Supply Costs

Year	Commodity Cost	Distribution	Carbon Tax	Total
2010	$ 5.59	0.15	0.75	$ 6.49
2011	$ 5.88	0.15	1.00	$ 7.03
2012	$ 6.61	0.15	1.25	$ 8.01
2013	$ 7.32	0.15	1.50	$ 8.97
2014	$ 7.92	0.15	1.50	$ 9.57
2015	$ 8.41	0.15	1.50	$ 10.06
2016	$ 8.82	0.15	1.50	$ 10.46
2017	$ 9.14	0.15	1.50	$ 10.78
2018	$ 9.35	0.15	1.50	$ 11.00
2019	$ 9.57	0.15	1.50	$ 11.22
2020	$ 9.78	0.15	1.50	$ 11.43
2021	$ 9.99	0.15	1.50	$ 11.64
2022	$ 10.21	0.15	1.50	$ 11.86
2023	$ 10.43	0.15	1.50	$ 12.08
2024	$ 10.66	0.15	1.50	$ 12.31
2025	$ 10.89	0.15	1.50	$ 12.54
2026	$ 11.13	0.15	1.50	$ 12.78
2027	$ 11.37	0.15	1.50	$ 13.02
2028	$ 11.62	0.15	1.50	$ 13.27
2029	$ 11.87	0.15	1.50	$ 13.52
2030	$ 11.87	0.15	1.50	$ 13.52

Avoided Supply Cost of Electricity

The avoided supply cost of electricity used in this analysis is $0.12/kWh.[23] This value is higher than the current average cost for BC Hydro to deliver electricity to a Lower Mainland busbar. The added cost reflects a number of recent bids for new electricity supply options. The value has adjusted to add 7% for area transmission and distribution losses between the busbar and the customer.

BC Hydro is confronted with higher supply costs for end uses such as space heating that have peaky requirements. However, detailed electricity supply costs were not available for this study for each of the defined load types. BC Hydro also did not generate distinct avoided cost values to be used for different regions in the last BC Hydro CPR. Furthermore, the current study is using the same natural gas avoided costs for all load types and regions. Consequently, it was decided to use the same avoided cost for electricity throughout the study.

Customer Energy Prices

The Commercial sector customer energy prices used in this analysis are $0.077/kWh for electricity and $0.0092/MJ for natural gas for most of the regions and $0.0159/MJ for Vancouver Island. Prices were obtained from a planning tool provided to the consultant team by FortisBC.

[23] $33.33/GJe.

5.3 Technologies and Measures

Exhibit 22 lists the energy-efficiency technologies and measures that are included in this study. A brief description of each measure is provided in Appendix C, while a detailed financial and economic assessment of each measure is provided in the measure TRC model that accompanies this report.

Exhibit 22 Efficiency and Alternative Energy Technologies Included in this Study

Space Heating
- Near-condensing boilers
- Condensing boilers
- Condensing unit heaters
- High-efficiency rooftop units
- Condensing rooftop units
- Infrared heaters
- High-efficiency forced air furnaces
- Absorption heat pumps
- Micro-combined heat & power
- Solar pre-heated make-up air
- Air-to-air heat recovery
- Demand controlled ventilation
- Demand controlled kitchen ventilation
- HVLS fans
- Programmable thermostats

Building Envelope
- High-performance glazings
- Super high-performance glazings
- Wall insulation upgrade
- Roof insulation upgrade
- Air sealing

Water Heating
- Condensing DHW boilers
- Condensing tank-type water heaters
- Tankless water heaters
- Drainwater heat recovery
- Low-flow faucet aerators & showerheads
- Low-flow pre-rinse spray valves
- Solar hot water heating

Cooking
- High-efficiency cooking equipment

Whole Building
- New construction – 25% more efficient
- New construction – 40% more efficient
- Recommissioning & advanced building automation (BAS)
- Operations & maintenance (O&M)

5.3.1 *Technology Screening Results*

A summary of the results is provided in Exhibit 23. For each of the measures reviewed, the exhibit shows:

- The name of the measure
- The cost basis[24] for the measure that is shown, e.g., “full” versus “incremental”
- The measure TRC
- The measure’s benefit-cost ratio

Measures analyzed on the basis of full cost have been placed towards the top of Exhibit 23, because they are qualitatively different from the measures that pass only on an incremental basis. A measure that passes on a full cost basis can be applied immediately, even if the piece of equipment that it replaces or improves is currently working properly. That means the rate at which the measure can be implemented as a utility DSM measure is limited by market and program constraints. Conversely, a measure that passes only on an incremental basis is limited

[24] See Step 3 in Section 5.2 for a detailed description.

by the rate of natural replacement (due to failure or obsolescence) or purchase of the piece of equipment it replaces.

Exhibit 23 Commercial Sector Energy-efficiency Technology Measures, Screening Results Lower Mainland

Measure Name	Basis (Full/Incremental)	Measure TRC	B-C Ratio
Pre-rinse spray valves	Full	$673	11.36
Low-flow faucet aerators	Full	$69	7.89
Demand-controlled kitchen ventilation	Full	$27,441	4.38
Building automation/recommissioning	Full	$4	3.70
Tankless hot water heater	Full	$4,813	3.19
Programmable thermostats	Full	$2	2.48
O&M improvements	Full	$0.10	1.94
Low-flow showerheads	Full	$17	1.70
Infrared heaters	Full	$0.27	1.06
High-volume low-speed fans	Full	-$0.46	0.92
Drainwater heat recovery	Full	-$98	0.89
Demand-controlled ventilation	Full	-$292	0.88
Air sealing	Full	-$0.25	0.76
Air-to-air heat recovery	Full	-$1	0.76
Solar pre-heated make-up air	Full	$0.00	0.31
Solar water pre-heat	Full	-$5,576	0.25
Micro-combined heat & power	Full	$0.00	N/A
Efficient new construction - 25% better	Incr.	$76	5.71
Near-condensing boilers	Incr.	$12,817	4.93
Efficient new construction - 40% better	Incr.	$99	3.05
Condensing boiler-based hot water heater	Incr.	$3,359	2.40
Condensing tank-type hot water heater	Incr.	$1,783	1.74
High-efficiency cooking equipment	Incr.	$1,929	1.48
Condensing boilers	Incr.	$7,711	1.42
Condensing unit heaters	Incr.	$139	1.08
Roof insulation	Incr.	-$0.08	0.99
Condensing rooftop HVAC units	Incr.	-$1,142	0.75
High-performance glazings	Incr.	-$17	0.69
Super high-performance glazings	Incr.	-$65	0.51
Wall insulation	Incr.	-$17	0.37
High-efficiency condensing gas furnaces	Incr.	-$1,017	0.31
Gas absorption heat pump	Incr.	-$9,197	0.26
High-efficiency rooftop HVAC units	Incr.	-$2,568	0.11

Highlights are summarized below.

- The most attractive measures pass the economic screen on a full-cost basis. This implies that they can be implemented immediately. In contrast, measures that pass the economic screen on an incremental cost basis are assumed to be implemented when equipment or material is being replaced.

- When the weighted average results are considered, 17 of the 33 measures analyzed pass the economic screen. However, there are several other measures that only marginally fail the economic screen on average. Some of these measures pass the economic screen in specific sub sectors and/or regions.

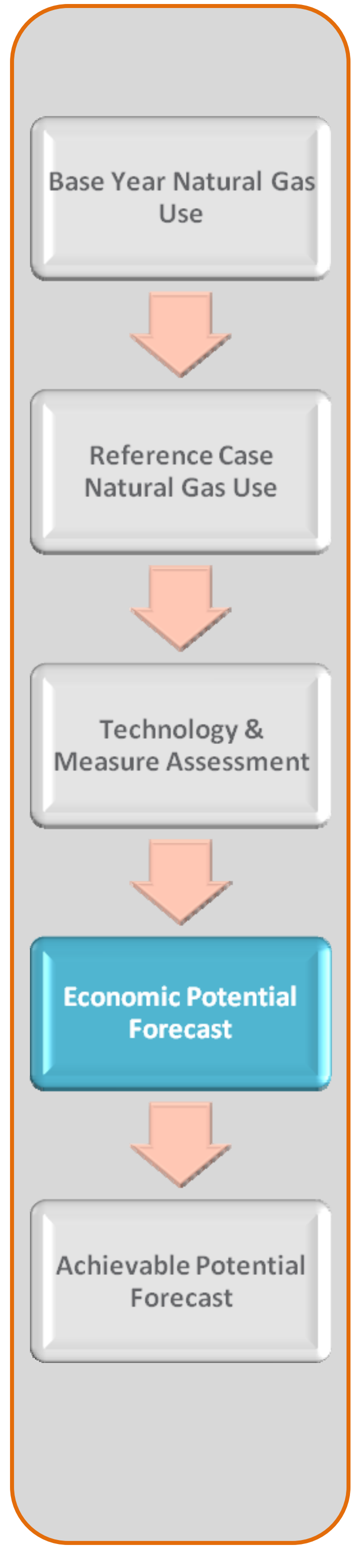
  - The most attractive measures include low-flow pre-rinse spray valves, faucet aerators, ultra low-flow showerheads, demand-controlled kitchen ventilation, programmable thermostats, tankless water heaters, DHW boilers and O&M measures

  - Measures that marginally fail the economic screen include air sealing, high-volume low-speed fans, drain water heat recovery, and high-performance glazings.

- Innovative new technologies, such as gas absorption heat pumps and micro-combined heat & power (CHP) units do not currently pass the economic screen. Although these measures are not currently economically attractive in a typical case, they may be suitable to pursue as part of a demonstration or pilot project.

6 Economic Potential Forecast

6.1 Introduction



This section presents the Commercial sector Economic Potential Forecast for the study period (2010 to 2030). The Economic Potential Forecast estimates the level of natural gas consumption that would occur if all building systems and equipment were upgraded to the level that is cost effective. In this study, "cost effective" means that the technology upgrade passes the measure TRC test, as discussed previously in Section 5.

The discussion in this section is organized into the following subsections:

- Major modelling tasks
- Technologies included in Economic Potential Forecast
- Presentation of results.

6.2 Major Modelling Tasks

By comparing the results of the Commercial sector Economic Potential Forecast with the Reference Case, it is possible to determine the aggregate level of potential natural gas savings within the Commercial sector, as well as identify which specific building segments, end uses and technologies can provide the most significant opportunities for savings.

To develop the Commercial sector Economic Potential Forecast, the following tasks were completed:

- The measure TRC results for each of the energy-efficiency upgrades presented previously in Exhibit 23 were reviewed.
- Technology upgrades that had positive measure TRC results were selected for inclusion either on a "full-cost" or "incremental" basis. Technical upgrades passing the measure TRC test on a full-cost basis were implemented in the first forecast year. Those upgrades that only passed the measure TRC test on an incremental basis were introduced as the existing stock reached the end of its useful life. If more than one cost-effective measure existed for the same end-use application, the study selected the most energy-efficient one.
- Energy use within each of the sub sectors was modelled with the same energy models that were used to generate the Reference Case. However, for this forecast, the remaining standard efficiency technologies included in the Reference Case were replaced with the most efficient technology upgrade option that passed the measure TRC test.
- When more than one upgrade option was applied to a given end use, the first measure selected was the one that reduced the energy load. For example, measures to reduce the overall DHW load (e.g., ultra low-flow showerheads) would be applied before a high-efficiency water heater.

6.3 Technologies Included in Economic Potential Forecast

Exhibit 24 provides a listing of the technologies selected for inclusion in the Economic Potential Forecast. In each case, the exhibit shows the following:

- End use affected
- Upgrade option(s) selected
- Rate at which the upgrade options were introduced into the stock.

Note that not all technologies are applied to all sub sectors and regions. In some cases, specific technologies are not applicable to some sub sectors (i.e., high-volume low-speed fans are not applicable in Office buildings), while other technologies pass the economic screen in a subset of regions and/or sub sectors in which they are technically appropriate, usually because of differences in climate conditions. Tables showing measure applicability by both sub sector and region are provided in Appendix D.

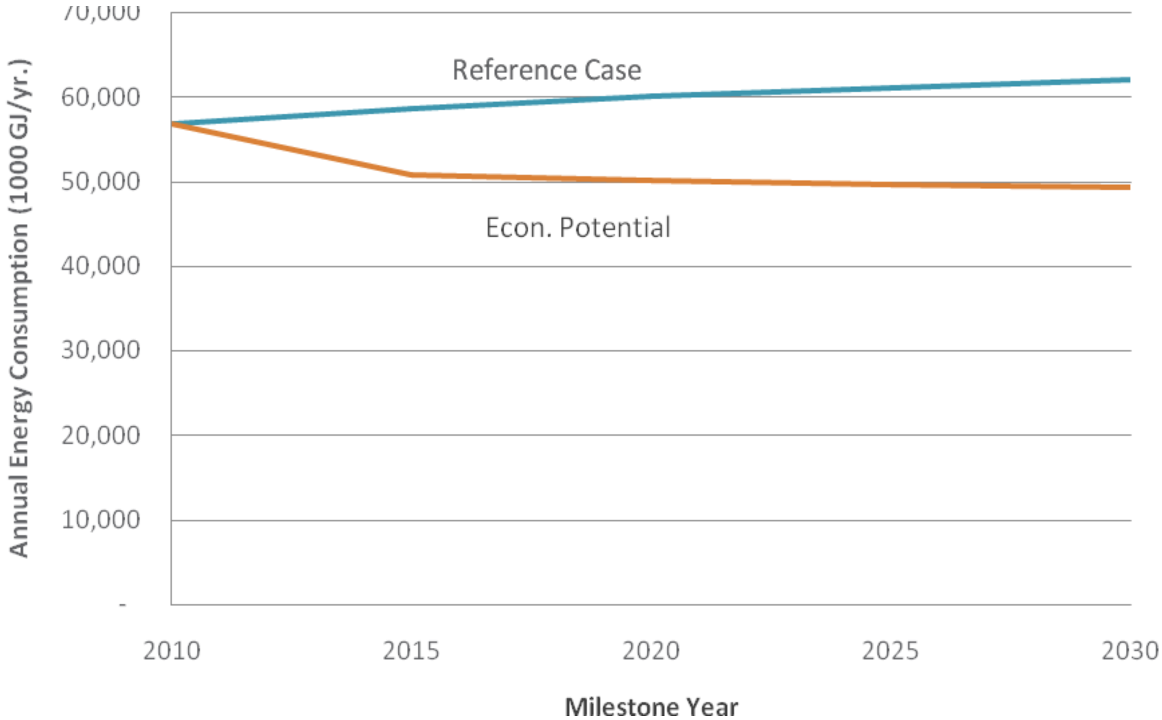
Exhibit 24 Technologies Included in the Economic Potential Scenario

End Use / Application	Upgrade Option	Rate of Stock Introduction
Cooking	High-efficiency cooking equipment	At rate of equipment replacement
Building Envelope	High-performance windows	At rate of replacement/ major building refit
	Roof insulation	At time of roof replacement
	Air sealing	Immediate
Space Heating	Programmable thermostat	Immediate
	Air-to-air heat recovery	Immediate
	Demand-controlled ventilation	Immediate
	Demand-controlled kitchen ventilation	Immediate
	Infrared radiant heating	At time of heating system replacement
	High-volume low-speed destratification fans	Immediate
	Condensing boilers	At time of heating system replacement
	Condensing unit heaters	At time of heating system replacement
	Condensing rooftop units	At time of heating system replacement
Water Heating	Low-flow fixtures	Immediate
	Low-flow pre-rinse spray valves	Immediate
	Condensing DHW boilers	At rate of equipment replacement
	Condensing tank-type water heaters	At rate of equipment replacement
	Drainwater heat recovery	Immediate
Whole Building	O&M measures	Immediate
	Advanced building automation systems/recommissioning	Immediate
Whole Building -New Building Design	New buildings - 40% better	Immediate

6.4 Presentation of Results

Exhibit 25 provides a comparison of the Reference Case and Economic Potential Forecast levels of commercial energy consumption. As illustrated, under the Reference Case, commercial natural gas consumption would rise slightly from the Base Year level of approximately 57 million GJ/yr. to almost 62 million GJ/yr. by 2030. This contrasts with the Economic Potential Forecast in which natural gas consumption would decrease to approximately 49.2 million GJ/yr. This is a difference of approximately 12.8 million GJ/yr., or about 20%.

Exhibit 25 Reference Case versus Economic Potential - Natural Gas Consumption for the Total FortisBC Service Area (1000 GJ/yr.)



6.4.1 Natural Gas Savings

Further detail on the total potential natural gas savings provided by the Economic Potential Forecast is provided in the following exhibits:

- Exhibit 26 presents the results for the total FortisBC service area by service region and milestone year.
- Exhibit 27 presents the results for the total FortisBC service area by sub sector and milestone year.
- Exhibit 28 presents the results for the total FortisBC service area by end use and milestone year.
- Exhibit 29 presents the results for the total FortisBC service area by technology and milestone year.

Exhibit 26 Natural Gas Savings for the Total FortisBC service area by Service Region and Milestone Year (GJ/yr.) - Economic Potential Scenario

Year	Lower Mainland	Vancouver Island	Southern Interior	Northern Interior	Whistler	Grand Total	% Savings Relative To Ref
2015	5,208,131	950,711	866,156	867,590	34,405	7,926,993	13.9%
2020	6,428,656	1,292,181	1,141,804	1,095,271	43,378	10,001,290	17.0%
2025	7,298,063	1,535,729	1,369,026	1,293,004	50,117	11,545,939	19.1%
2030	7,938,303	1,748,436	1,582,937	1,481,851	55,647	12,807,174	20.9%
Savings 2030 Relative to reference	19%	23%	24%	28%	21%	21%	
Percent of total 2030 Savings	62%	14%	12%	12%	0.4%	100%	

Exhibit 27 Natural Gas Savings for the Total FortisBC Service Area by Sub sector and Milestone Year (GJ/yr.) - Economic Potential Scenario

Sub Sector	2015	2020	2025	2030	2030 % Savings Relative to Ref Case	% of Total 2030 Savings
Large Office	191,784	241,289	284,556	325,716	20%	2.6%
Medium Office	96,404	118,604	137,764	156,015	16%	1.2%
Large Non-food Retail	169,190	201,194	228,154	253,800	18%	2.0%
Medium Non-food Retail	98,235	121,283	139,089	156,205	16%	1.2%
Food Retail	61,703	77,846	86,675	95,161	17%	0.7%
Large Hotel	131,682	165,119	186,616	207,214	22%	1.6%
Medium Hotel	60,006	80,643	96,494	107,173	21%	0.8%
Hospital	673,505	752,700	815,327	875,358	26%	6.9%
Nursing Home	215,033	270,690	313,082	351,305	24%	2.8%
Large School	218,921	286,157	342,239	390,055	24%	3.1%
Medium School	165,968	227,161	282,176	333,799	26%	2.6%
University/College	335,684	439,861	521,067	595,739	21%	4.7%
Restaurant	677,431	946,529	1,021,607	1,067,788	22%	8.4%
Warehouse/Wholesale	54,176	59,129	63,459	67,585	27%	0.5%
Large Apartment	1,395,450	1,663,899	1,898,980	2,068,463	22%	16.2%
Medium Apartment	715,513	877,664	1,023,975	1,096,115	21%	8.6%
Small Commercial	2,089,693	2,714,690	3,210,650	3,646,943	19%	28.6%
Other	542,210	713,452	843,911	957,094	20%	7.5%
Grand Total	**7,892,588**	**9,957,912**	**11,495,822**	**12,751,527**	**21%**	**100%**

Note: Any difference in totals is due to rounding.

Exhibit 28 Natural Gas Savings for the Total FortisBC Service Area by End Use and Milestone Year (GJ/yr.) - Economic Potential Scenario

Sub Sector	2015	2020	2025	2030	% Savings 2030 Relative to Ref Case	% Savings 2030 Relative to Total 2030 Savings
Commercial Cooking	468,607	947,257	983,412	1,018,031	18%	8%
DHW	2,444,401	3,116,868	3,741,332	4,105,280	27%	32%
Space Heating	4,979,580	5,893,788	6,771,078	7,628,215	22%	60%
Grand Total	7,892,588	9,957,912	11,495,822	12,751,527	21%	100%

Any difference in totals is due to rounding.

Exhibit 29 Natural Gas Savings for the Total FortisBC Service Area by Technology and Milestone Year (1000 GJ/yr.) - Economic Potential Scenario

Measure	2015	2020	2025	2030	% Savings Relative to Total 2030 Savings	Average B-C Ratio
Air sealing	17,567	16,652	15,753	14,871	0.1%	1.86
Air-to-air heat recovery	725,090	709,518	694,102	678,843	5.3%	1.52
BAS and recommissioning	755,488	732,211	709,236	686,562	5.4%	2.49
Condensing boilers	431,015	837,833	1,220,886	1,580,603	12.4%	1.70
Condensing DHW (boiler)	156,650	308,529	455,636	597,973	4.7%	3.08
Condensing DHW (tank type)	171,781	332,557	482,595	466,622	3.7%	2.58
Condensing rooftop units	9,157	17,214	24,195	30,126	0.2%	1.83
Condensing UH	726	1,388	1,987	2,524	0.0%	1.21
DCKV	52,877	51,217	49,577	47,958	0.4%	5.27
Demand ctrl vent.	9,878	9,279	8,688	8,107	0.1%	1.17
Drainwater HR	57,709	54,937	52,231	49,699	0.4%	1.19
High-efficiency cooking	312,343	621,151	636,564	650,463	5.1%	1.62
High-performance glazings	6,280	12,466	18,556	24,552	0.2%	1.12
HVLS fans	8,669	8,287	7,909	7,537	0.1%	1.19
Infrared heaters	17,050	16,298	15,556	14,824	0.1%	1.16
Ultra low-flow fixtures	653,458	643,507	633,556	623,605	4.9%	8.61
New construction 40% better	137,065	258,593	358,921	453,200	3.6%	3.07
O&M	1,072,901	1,053,684	1,034,607	1,015,669	8.0%	1.38
Pre-rinse spray valves	198,990	195,960	192,929	189,899	1.5%	16.70
Programmable thermostats	271,495	262,831	254,274	245,823	1.9%	2.77
Roof insulation	194,496	385,660	573,502	758,030	5.9%	1.26
Aggregate savings[25]	2,631,903	3,428,142	4,054,561	4,604,036	36.1%	-

Note: Several measures, such as BAS/Recommissioning and O&M, have associated savings across more than one end use.

[25] The aggregate savings (36%) are from the "Small Commercial" and "Recreational and Other" sub sectors, which were not modelled by end use; however, it can be assumed that relative savings by end use would be similar to those in the modelled sub sectors.

Note that the average benefit-cost ratios in Exhibit 29 differ from those presented in Exhibit 23 because these ratios are based on all combinations of sub sectors and regions only *where the measure passes the economic screen*.

6.4.2 *Interpretation of Results*

Highlights of the potential natural gas savings presented in the preceding exhibits are summarized below.

Savings by Service Region

The Lower Mainland service region represents 62% of the identified savings, which is consistent with the large number of customers in this service region. Vancouver Island accounts for 14% of all identified savings. The Southern and Northern Interior regions each represent 12% of the identified savings.

In the Northern Interior region, potential savings are 28% of the Reference Case consumption in 2030, the highest percentage of any of the regions. In the Lower Mainland region, potential savings are 19% of the Reference Case consumption in 2030, the lowest of any of the regions. Differences in relative savings between regions are primarily due to variation in space heating loads, which lead to some variance by region in the measures that pass the economic screen.

Savings by Milestone Year

Sixty-two percent of the total identified Economic Potential savings are economically feasible by 2015. This is because the majority of measures that are cost effective pass the economic screen at full cost (i.e., it is economically attractive to implement them immediately),[26] and are therefore implemented immediately under the Economic Potential scenario.

The expected impact of natural conservation in the Commercial sector is also an important factor that causes 2015 savings to be relatively large in proportion to the total 2030 savings. Savings are calculated based on the expected difference between the Reference Case, which includes savings from natural conservation, and the Economic Potential Forecast. As naturally-occurring savings gradually increase over the study period, they erode some of the Economic Potential.

Savings by Sub sector

Small Commercial buildings represent approximately 29% of the total Economic Potential savings, followed by Large Apartment buildings at 16%, Restaurants at just over 8% and Other Commercial at almost 8%.

There are two primary drivers of relative savings by sub sector:

- Base case consumption by sub sector is highly correlated with Economic Potential savings by sub sector.

[26] See Exhibit 23 for a summary of the basis (full/incremental) by which measures pass the economic screen for the Lower Mainland region.

- Sub sectors with high DHW EUIs tend to contribute more potential savings to the Economic Potential scenario total, as there are slightly more economically attractive savings available for the DHW end use than in other end uses.

Savings by End Use

- Within the modelled sub sectors:
  - Space heating savings account for approximately 60% of total energy savings in the Economic Potential Forecast. Advanced BAS/recommissioning, air-to-air heat recovery, and O&M measures make significant contributions to this total.
  - DHW savings account for approximately 32% of the total energy savings in the Economic Potential Forecast. The largest contributors are condensing DHW boilers, ultra low-flow fixtures and condensing DHW tanks.
  - Cooking savings account for approximately 8% of the total energy savings in the Economic Potential Forecast.
- The sub sectors Small Commercial and Recreation Facilities and Other were not modelled at the same level of end-use detail due to data constraints. In the absence of detailed data it is assumed that the distribution of end-use savings within the non-modelled sub sectors would be similar to those in the modelled sub sectors.

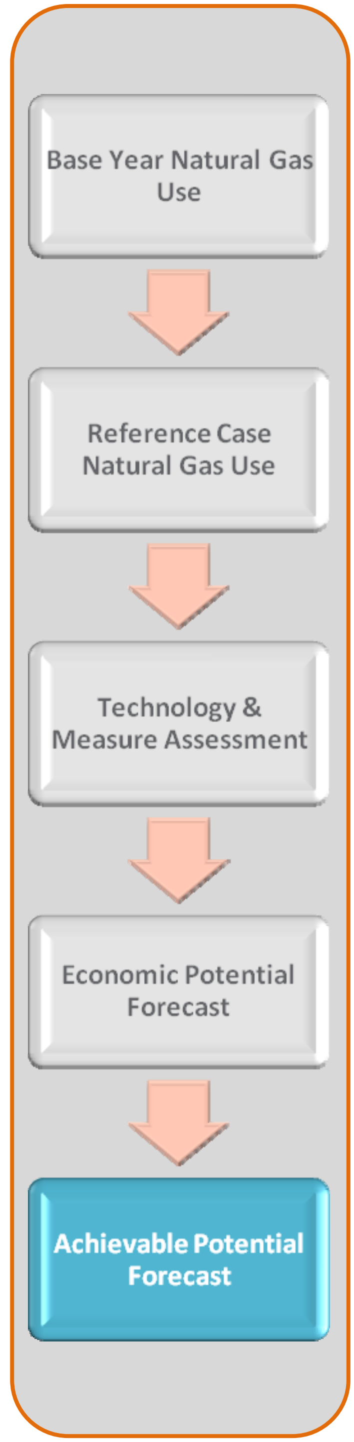
6.4.3 *Caveats on Interpretation of Results*

A systems approach was used to model the energy impacts of the efficiency upgrades presented in the preceding section. In the absence of a systems approach, there would be double counting of savings and an accurate assessment of the total contribution of the energy-efficient upgrades would not be possible.

For example, programmable thermostats reduce space heating natural gas use, as does the installation of new energy-efficient windows. On its own, each measure will reduce overall space heating energy use. However, the two savings are not cumulative. The order in which some upgrades are introduced is also important. In this study, the approach has been to select and model the impact of measures that reduce the load for a given end use (e.g., wall insulation or window upgrades that reduce the space heating load) and then to introduce measures that meet the remaining load more efficiently (e.g., a high-efficiency space heating system).

The above approach means that where there is interaction between measures that affect the same end use, the savings for the individual measures shown in Exhibit 29 are reduced. For example, if the programmable thermostat measure were implemented in the absence of any other space heating measures, its savings would be greater than those shown in Exhibit 29. As appropriate, this issue is addressed in Section 7 of this report.

7 Achievable Potential



7.1 Introduction

This section presents the Commercial sector Achievable Potential for the study period (2010 to 2030). The Achievable Potential is defined as the proportion of the energy-efficiency opportunities identified in the Economic Potential Forecast that could realistically be achieved within the study period.

The remainder of this discussion is organized into the following subsections:

- Description of Achievable Potential
- Approach to the estimation of Achievable Potential
- Results – energy-efficient technologies.

7.2 Description of Achievable Potential

Achievable Potential recognizes that, in many instances, it is difficult to induce all customers to purchase and install all the energy-efficiency technologies that meet the criteria defined by the Economic Potential Forecast. For example, customer decisions to implement energy-efficient measures can be constrained by important factors such as:

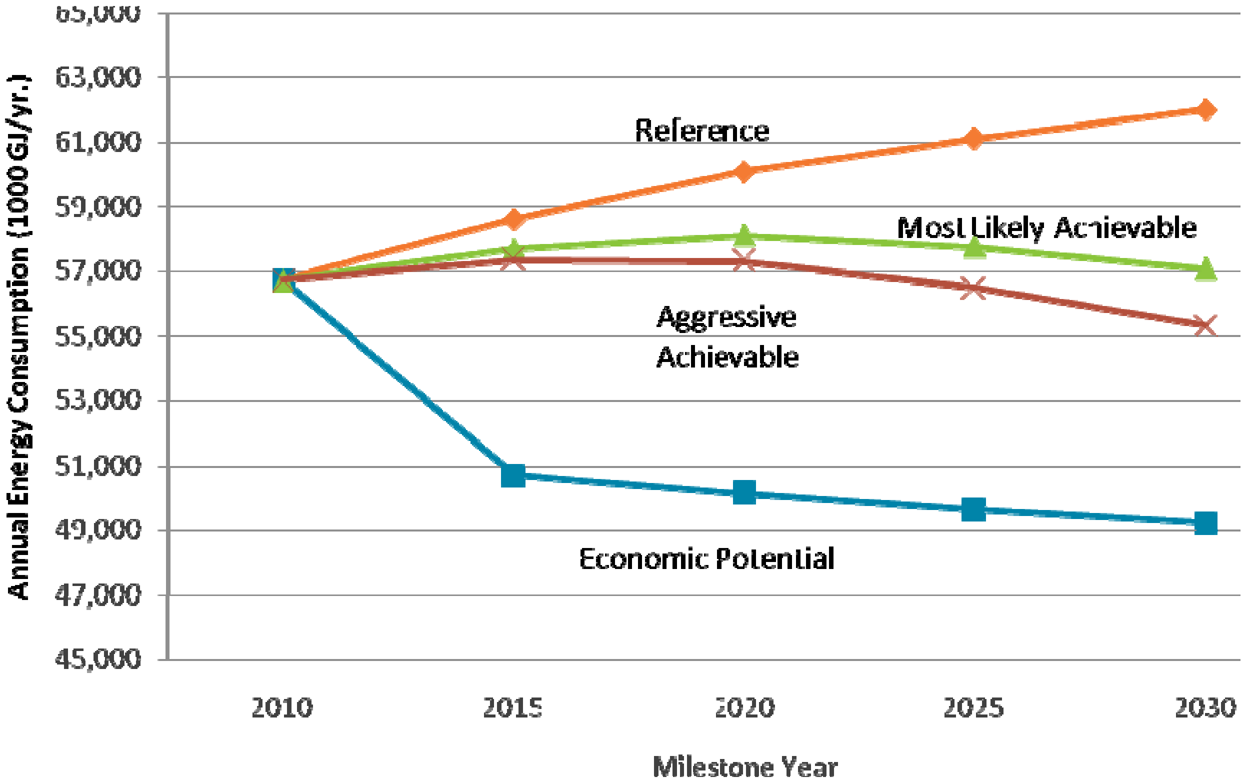
- Higher first cost of efficient product(s)
- Need to recover investment costs in a short period (payback)
- Lack of product performance information or unsubstantiated performance claims
- Lack of product availability.

The rate at which customers accept and purchase energy-efficiency products will be influenced by the level of financial incentives, information and other measures put in place by FortisBC, BC Hydro, governments and the private sector to remove barriers such as those noted above.

Exhibit 30 presents the levels of natural gas consumption that are estimated in the Achievable Potential scenario. As illustrated, the Achievable Potential scenarios are *banded* by the two forecasts presented in previous sections, namely the Economic Potential Forecast and the Reference Case.

As illustrated in Exhibit 30 energy savings under the Achievable Potential scenario are less than in the Economic Potential Forecast. In this CPR, the primary factor that contributes to the outcome shown in Exhibit 30 is the rate of market penetration. In the Economic Potential Forecast, efficient new technologies are assumed to fully penetrate the market as soon as it is economically attractive to do so. However, the Achievable Potential recognizes that under real world conditions, the rate at which customers are likely to implement new technologies will be influenced by additional practical considerations and will, therefore, occur more slowly than under the assumptions employed in the Economic Potential Forecast.

Exhibit 30 Annual Natural Gas Consumption—Achievable Potential Scenarios Relative to Reference Case and Economic Potential Forecast (1000 GJ/yr.)



As also illustrated in Exhibit 30, the Achievable results are presented as a band of possibilities, rather than a single line. This is because any estimate of Achievable Potential over a 20-year period is necessarily subject to uncertainty. Consequently, two Achievable Potential scenarios are presented: *most likely* and *aggressive*.

The *most likely* Achievable Potential assumes British Columbia market conditions that are similar to those contained in the Reference Case. That is, customers' awareness of energy-efficiency options and their motivation levels remain similar to those in the recent past, technology improvements continue at historical levels and new energy performance standards continue as per current known schedules. It also assumes that FortisBC's ability to influence customers' decisions towards increased investments in energy-efficiency options remains roughly in line with previous company DSM experience.

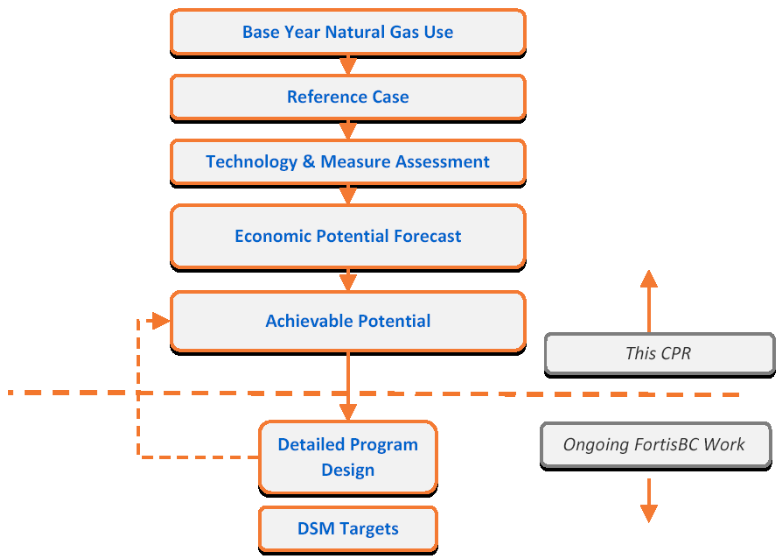
The *aggressive* Achievable Potential assumes British Columbia market conditions that aggressively support investment in energy efficiency. For example, this scenario assumes that real energy prices increase over the study period and that federal and provincial government actions to mitigate climate change result in increased levels of complementary energy-efficiency initiatives. *Aggressive* Achievable Potential typically does not reach Economic Potential levels; this recognizes that some portion of the market is typically constrained by barriers that cannot realistically be affected by DSM programs within the study period.

7.2.1 Achievable Potential Versus Detailed Program Design

It should also be emphasized that the estimation of Achievable Potential is not synonymous with either the setting of specific program targets or with program design. While both are closely linked to the discussion of Achievable Potential, they involve more detailed analysis that is beyond the scope of this study.

Exhibit 31 illustrates the relationship between Achievable Potential and the more detailed program design.

Exhibit 31 Achievable Potential versus Detailed Program Design



7.3 Approach to the Estimation of Achievable Potential

Achievable Potential was estimated in a five-step approach.

- Priority opportunities were selected
- Opportunity profiles were created
- Opportunity worksheets were prepared
- A full-day workshop was held
- Workshop results were aggregated and applied to the remaining opportunities.

Further discussion is provided below.

7.3.1 Step 1: Select Priority Opportunities

The first step in developing the Achievable Potential estimates required selection of the energy saving opportunities identified in the Economic Potential Forecasts to be discussed during the Achievable workshop. Several criteria determined selection, including:

- The priority measures should represent a substantial fraction of the overall Economic Potential
- The priority measures should represent several different energy end uses

- The priority measures should have a variety of different likely patterns of market adoption so the discussions will be widely varied.

A summary of the selected energy-efficiency actions discussed, along with the approximate percentage of 2030 Economic Potential savings that each represents, is provided in Exhibit 32.

Exhibit 32 Commercial Sector Priority Opportunities – Energy Efficiency

Action Profile #	Measure	End Use	% Savings 2030 Relative to Total 2030 Savings
C1	Ultra low-flow fixtures	Water Heating	8%
C2	Roof insulation	Space Heating	9%
C3	Condensing DHW tank	Water Heating	6%
C4	High-efficiency cooking equipment	Cooking	8%
C5	High-efficiency boilers	Space Heating	19%
C6	Recommissioning	All	8%
C7	O&M measures	All	12%
C8	New construction measures	All	6%
Grand Total			77%

7.3.2 Step 2: Create Opportunity Profiles

The next step involved the development of brief profiles for each of the opportunities noted above in Exhibit 32, in the form of four or five PowerPoint slides. The slides are presented in Appendix D.

The purpose of the opportunity profiles was to provide a high-level logic framework that would serve as a guide for participant discussions in the Achievable workshop (see Section 7.3.3 below). The intent was to define a broad rationale and direction without getting into the much greater detail required of program design, which, as noted previously, is beyond the scope of this project. As illustrated in Appendix D, each opportunity profile addresses the following areas:

Technology Description – provides a summary statement of the broad goal and rationale for the Action.

Target Sub Sector and Typical Application – highlights the sub sectors and applications offering the most significant opportunities and which provide a good starting point for discussion of the technology.

Financial and Economic Indicators – provides estimates of average simple payback, benefit-cost ratio (TRC analysis), and basis of assessment (full cost versus incremental).

Eligible Participants – provides an estimate of the number of buildings within the target sub sector that could be affected during the study period if the entire Economic Potential were to be captured.

Economic Potential versus Time – shows the pattern of the changing size of the opportunity over the study period, for existing and new buildings. Some opportunities grow steadily through the study period, as more and more appliances reach the age when they would be replaced. Other opportunities are economic to capture immediately, and after that the growth over time is limited to opportunities in new buildings being built. Still other opportunities decline with time as they are eroded by natural conservation activities.

Economic Potential versus Sub Sector and Region – shows how the opportunity is distributed through FortisBC's service area.

7.3.3 Step 3: Prepare Opportunity Worksheets

A draft assessment worksheet was prepared for each opportunity profile in advance of the Achievable workshop. The assessment worksheets complemented the information contained in the opportunity profiles by providing quantitative data on the potential energy savings for each opportunity as well as providing information on the size and composition of the eligible population of potential participants. Energy impacts and population data were taken from the detailed modelling results contained in the Economic Potential Forecast.

The worksheets, including the results recorded during the workshop discussions, are provided in Appendix E. As illustrated in Appendix E, each opportunity assessment worksheet addresses the following areas:

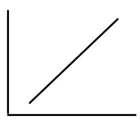
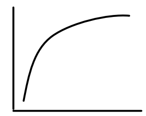
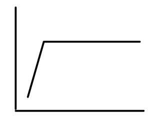
Approximate Benefit-Cost Ratio – shows the approximate ratio of economic benefits to costs. The benefit-cost ratio provides an indication of the relative economic attractiveness of the energy-efficiency measures from FortisBC's perspective. For the purposes of the workshop, this information provided participants with an indication of the scope for using financial incentives to influence customer participation rates.

Customer Payback – shows the simple payback from the customer's perspective for the package of energy-efficiency measures included in the opportunity. This information provided an indication of the level of attractiveness that the opportunity would present to customers. This provided an important reference point for the workshop participants when considering potential participation rates. When combined with the preceding benefit-cost information, participants were able to "roughly" estimate the level of financial incentive that could be employed to increase the opportunity's attractiveness to customers without making it economically unattractive to FortisBC***.***

Economic Potential in Terms of Applicable Participants (e.g., square footage, number of buildings) – shows the total number of potential participants in terms of both square footage and estimated number of buildings that could theoretically take part in the opportunity. Numbers shown are from the eligible populations used in the Economic Potential Forecasts.

Participation Rates (%) – these fields were filled in during the workshops (described below in Step 4), based on input from the participants. They show the percentage of economic savings that workshop participants concluded could be achievable in the last milestone period (usually 2030, but may be earlier for measures that peak earlier). As noted in the introduction to this section, two Achievable levels are shown: *most likely* and *aggressive*. Under the comments column, participants indicated a likely shape for a curve to describe how quickly activity would rise to that level, so that participation rates for the intervening milestone years could be estimated. The various curves used in the discussion are shown in Exhibit 33.

Exhibit 33 Sample Participation Curves for Achievable Workshops

Curve A	Curve B	Curve C	Curve D
			

Achievable Potential in Terms of Applicable Participants (e.g., square footage, number of buildings) – these fields were calculated based on the participation rates provided by the participants.

Participation Rates Relative to the Discussion Scenario – these fields were filled in during the workshops to provide guidance to the consulting team on how participation might differ in other regions or sub sectors.

Other Parameters – these fields were filled in during the workshop to capture other aspects of the discussion. In addition, the consulting team members took notes on the discussion, a summary of which is included in Appendix E-1.

7.3.4 Step 4: Achievable Workshop

The most critical step in developing the estimates of Achievable Potential was a one-day Achievable Potential workshop that was held on January 26, 2011. Workshop participants consisted of core members of the consultant team, DSM program and technical personnel from FortisBC, and industry representatives. Together, the participating personnel brought many years of experience to the workshop related to the technologies and markets as well as the design and delivery of energy-efficiency programs in British Columbia.

The purpose of this workshop was to:

- Promote discussion regarding the technical and market constraints confronting the identified energy-efficiency opportunities
- Identify potential strategies for addressing the identified constraints, including potential partners and delivery channels
- Compile participant views related to how much of the identified economic savings could realistically be achieved over the study period.

The discussion of each opportunity profile began with a brief consultant presentation. The floor was then opened to participant discussion of the key factors affecting each of the market segments and technical opportunities contained in the opportunity profile and accompanying worksheet.

Following discussion of the broad market and intervention conditions affecting the opportunity, workshop participant views were recorded on the *most likely* and *aggressive* customer participation rates. General agreement was sought on rates to be carried forward into the analysis.

As noted earlier, it was not possible to fully address all opportunities in the one-day workshop. Consequently, the workshop focused on opportunities selected based on the criteria described in Step 1. The consultants extrapolated to estimate participation for the remaining opportunities, consulting with FortisBC program personnel as needed. The values shown in the attached appendices and in the following summary tables incorporate the results of all these inputs.

7.3.5 Step 5: Aggregate Opportunity Results

The final step involved aggregating the results of the individual opportunities to provide a view of the Achievable Potential savings for the total Commercial sector.

7.4 Results – Efficient Technologies

A summary of the *most likely* and *aggressive* Achievable Potential results for the energy-efficiency opportunities is presented in this section. These results include the following:

- Natural gas consumption savings
- Peak day load impacts
- Greenhouse gas emission reductions.

7.4.1 Natural Gas Consumption Savings – Aggressive Achievable Scenario

The following exhibits present the potential natural gas savings under the *aggressive* Achievable Potential scenario. The results shown are relative to the Reference Case. The results are broken down as follows:

- Exhibit 34 presents the results for the total FortisBC service area by service region and milestone year.

- Exhibit 35 presents the results for the total FortisBC service area by sub sector and milestone year.

- Exhibit 36 presents the results for the total FortisBC service area by end use and milestone year.

Exhibit 34 Natural Gas Savings for the Total FortisBC Service Area by Service Region and Milestone Year (GJ/yr.) - Aggressive Achievable Scenario

Year	Lower Mainland	Vancouver Island	Southern Interior	Northern Interior	Whistler	Grand Total	% Savings Relative To Ref
2015	840,486	138,461	138,763	157,282	5,558	1,280,551	2.2%
2020	1,829,542	321,997	314,141	343,240	12,236	2,821,156	4.7%
2025	2,968,458	551,059	535,401	564,437	20,139	4,639,492	7.6%
2030	4,201,990	823,992	798,192	808,906	28,947	6,662,026	10.7%
Savings 2030 relative to reference	9.9%	11.0%	12.0%	15.2%	10.7%	10.7%	
Savings 2030 relative to Total 2030 Savings	63%	12%	12%	12%	0.4%	100%	

Exhibit 35 Natural Gas Savings for the Total FortisBC Service Area by Sub Sector and Milestone Year (GJ/yr.) - Aggressive Achievable Scenario

Sub Sector	2015	2020	2025	2030	% Savings 2030 Relative to Ref Case	% Savings 2030 Relative to Total 2030 Savings
Large Office	37,780	83,090	135,372	194,245	12.0%	2.9%
Medium Office	19,002	40,986	65,942	93,936	9.5%	1.4%
Large Non-food Retail	33,849	70,919	112,351	159,090	11.0%	2.4%
Medium Non-food Retail	17,395	36,763	59,078	85,388	8.5%	1.3%
Food Retail	10,831	22,970	36,618	52,316	9.5%	0.8%
Large Hotel	20,380	45,137	74,315	108,525	11.2%	1.6%
Medium Hotel	9,361	20,977	35,537	52,436	10.1%	0.8%
Hospital	112,451	236,757	371,286	504,625	14.8%	7.6%
Nursing Home	35,922	79,818	132,244	189,305	12.8%	2.9%
Large School	41,735	93,190	155,328	221,209	13.6%	3.3%
Medium School	29,100	67,276	116,353	173,984	13.5%	2.6%
University/College	64,132	143,671	238,480	339,732	11.6%	5.1%
Restaurant	86,980	197,907	328,911	479,294	9.5%	7.2%
Warehouse/Wholesale	6,488	15,293	24,641	34,726	13.7%	0.5%
Large Apartment	222,518	475,179	764,111	1,080,620	11.5%	16.3%
Medium Apartment	107,842	233,700	383,163	543,783	10.3%	8.2%
Small Commercial	334,939	753,649	1,263,001	1,846,194	9.6%	27.8%
Other	84,288	191,639	322,624	473,670	9.4%	7.1%
Grand Total	**1,274,993**	**2,808,920**	**4,619,354**	**6,633,079**	**10.7%**	**100%**

Note: Any difference in totals is due to rounding.

Exhibit 36 Natural Gas Savings for the Total FortisBC Service Area by End Use and Milestone Year (GJ/yr.) - Aggressive Achievable Scenario

End Use	2015	2020	2025	2030	% Savings 2030 Relative to Ref Case	% Savings 2030 Relative to Total 2030 Savings
Commercial Cooking	7,389	56,761	130,108	236,763	4.2%	4%
DHW	383,670	841,837	1,410,241	2,056,516	13.8%	31%
Space Heating	883,934	1,910,322	3,079,005	4,339,801	13.0%	65%
Grand Total	1,274,993	2,808,920	4,619,354	6,633,079	10.7%	100%

Note: Any difference in totals is due to rounding.

7.4.2 *Natural Gas Consumption Savings – Most Likely Achievable Scenario*

The following exhibits present the potential natural gas savings under the *most likely* Achievable Potential scenario. The results shown are relative to the Reference Case. The results are broken down as follows:

- Exhibit 37 presents the results for the total FortisBC service area by service region and milestone year.
- Exhibit 38 presents the results for the total FortisBC service area by sub sector and milestone year.
- Exhibit 39 presents the results for the total FortisBC service area by end use and milestone year.

Exhibit 37 Natural Gas Savings for the Total FortisBC Service Area by Service Region and Milestone Year (GJ/yr.) - Most Likely Achievable Scenario

Year	Lower Mainland	Vancouver Island	Southern Interior	Northern Interior	Whistler	Grand Total	% Savings Relative To Ref
2015	616,847	97,304	104,947	111,148	5,355	935,601	1.6%
2020	1,295,869	219,093	229,318	246,411	11,461	2,002,153	3.3%
2025	2,176,854	389,493	394,042	418,320	18,469	3,397,178	5.5%
2030	3,112,172	593,682	589,051	620,202	26,100	4,941,206	7.9%
Savings 2030 Relative to reference	7.3%	7.9%	8.9%	11.6%	9.6%	7.9%	
Savings 2030 Relative to Total 2030 Savings	63%	12%	12%	13%	0.5%	100%	

Exhibit 38 Natural Gas Savings for the Total FortisBC Service Area by Sub Sector and Milestone Year (GJ/yr.) - Most Likely Achievable Scenario

Sub Sector	2015	2020	2025	2030	% Savings 2030 Relative to Ref Case	% Savings 2030 Relative to Total 2030 Savings
Large Office	24,277	57,168	99,977	149,995	9.2%	3.1%
Medium Office	11,346	27,074	47,932	72,760	7.3%	1.5%
Large Non-food Retail	20,917	47,712	81,972	122,602	8.5%	2.5%
Medium Non-food Retail	9,807	23,404	41,876	64,888	6.4%	1.3%
Food Retail	7,203	15,799	26,761	39,464	7.1%	0.8%
Large Hotel	16,518	33,401	55,435	78,616	8.1%	1.6%
Medium Hotel	7,508	15,243	26,004	37,315	7.2%	0.8%
Hospital	80,698	170,956	277,576	391,187	11.4%	8.0%
Nursing Home	26,398	57,289	97,519	142,823	9.7%	2.9%
Large School	27,555	64,558	113,648	171,773	10.6%	3.5%
Medium School	18,021	44,991	83,334	131,953	10.2%	2.7%
University/College	43,296	100,234	175,426	263,195	9.0%	5.4%
Restaurant	80,193	153,480	247,093	334,494	6.7%	6.8%
Warehouse/Wholesale	4,107	10,509	18,011	26,457	10.4%	0.5%
Large Apartment	162,979	335,511	559,831	794,581	8.4%	16.2%
Medium Apartment	87,951	173,542	283,684	390,100	7.4%	7.9%
Small Commercial	241,293	527,453	911,955	1,357,598	7.1%	27.6%
Other	60,181	132,367	230,676	345,306	6.9%	7.0%
Grand Total	**930,246**	**1,990,692**	**3,378,709**	**4,915,107**	**7.9%**	**100%**

Note: Any difference in totals is due to rounding.

Exhibit 39 Natural Gas Savings for the Total FortisBC Service Area by End Use and Milestone Year (GJ/yr.) - Most Likely Achievable Scenario

End Use	2015	2020	2025	2030	% Savings 2030 Relative to Ref Case	% Savings 2030 Relative to Total 2030 Savings
Commercial Cooking	4,717	36,212	83,000	151,441	2.7%	3%
DHW	400,468	683,643	1,067,311	1,367,484	9.2%	28%
Space Heating	525,061	1,270,837	2,228,397	3,396,181	10.2%	69%
Grand Total	**930,246**	**1,990,692**	**3,378,709**	**4,915,107**	**7.9%**	**100%**

Note: Any difference in totals is due to rounding.

7.4.3 Savings Comparison – Aggressive and Most likely Achievable Scenarios

As a point of comparison, Exhibit 40 below expresses the *most likely* Achievable scenario savings as a percentage of the *aggressive* Achievable scenario savings by region and milestone year.

Exhibit 40 Natural Gas Savings for the Total FortisBC Service Area by Region and Milestone Year (GJ/yr.) - Achievable Scenario Savings Comparison

Year	Lower Mainland	Vancouver Island	Southern Interior	Northern Interior	Whistler	Grand Total
2015	73%	70%	76%	71%	73%	73%
2020	71%	68%	73%	72%	71%	71%
2025	73%	71%	74%	74%	73%	73%
2030	74%	72%	74%	77%	74%	74%

7.4.4 Peak Day Load Impacts – Energy-efficiency Scenarios

This sub section estimates the peak day load impact that would occur as a result of the Achievable Potential scenarios presented in the preceding exhibits. Peak day load impact measures the relationship between a typical or average daily consumption rate and the consumption that occurs on a peak day when the demand for natural gas is at a maximum. The relationship is illustrated in the formula below.

$$\textit{Peak Day Consumption} = \frac{\textit{Average Daily Consumption}}{\textit{Load Factor}}$$

The following steps were employed to derive the estimated peak day load impacts:

- Annual natural gas decreases associated with each of the preceding Achievable Potential scenarios were identified (GJ/yr.).

FortisBC provided load factors that correlate the relationship between average and peak day consumption levels for each rate class and service region. Commercial sector customers, as defined in this CPR, include accounts in all rate classes except rate 1. The overall commercial peak day load factors therefore represent a consumption-weighted average of the various rate class peak day load factors. Exhibit 41 shows a Commercial sector load factors ranging from 0.288 in the Northern Interior Region to 0.380 in the Vancouver Island Region.

Exhibit 41 Peak Day Load Factors, by Sector and Service Region

CPR Sector	Lower Mainland	Vancouver Island	Northern Interior	Southern Interior
Residential	0.272	0.279	0.266	0.266
Commercial	0.358	0.380	0.288	0.298
Industrial	0.589	0.384	0.862	0.812

- Finally, peak day load impacts were calculated by dividing the average daily consumption by the appropriate sector and service region load factors.

Exhibit 42 and Exhibit 43 summarize the estimated peak day load impacts for each of the Achievable Potential scenarios. The results for the *aggressive* Achievable Potential are presented in Exhibit 42 and the results for the *most likely* Achievable Potential are presented in Exhibit 43.

Exhibit 42 Peak Day Capacity Impacts, By Scenario, Service Region and Milestone Year (GJ) – Aggressive Achievable Scenario

Year	Lower Mainland	Vancouver Island	Southern Interior	Northern Interior	Whistler	Grand Total
2015	6,424	1,058	1,061	1,202	42	9,787
2020	13,983	2,461	2,401	2,623	94	21,562
2025	22,688	4,212	4,092	4,314	154	35,459
2030	32,115	6,298	6,100	6,182	221	50,917
Savings 2030 Relative to Total 2030 Savings	63%	12%	12%	12%	0.4%	100%

Exhibit 43 Peak Day Capacity Impacts, By Scenario, Service Region and Milestone Year (GJ) - Most Likely Achievable Scenario

Year	Lower Mainland	Vancouver Island	Southern Interior	Northern Interior	Whistler	Grand Total
2015	4,714	744	802	849	31	7,141
2020	9,904	1,675	1,753	1,883	66	15,281
2025	16,637	2,977	3,012	3,197	113	25,936
2030	23,786	4,537	4,502	4,740	164	37,729
Savings 2030 Relative to Total 2030 Savings	63%	12%	12%	13%	0.4%	100%

7.4.5 Greenhouse Gas Emission Impact – Energy-efficiency Scenarios

The natural gas savings associated with each of the Achievable Potential scenarios would also result in a reduction of greenhouse gas (GHG) emissions.[27] Exhibit 44 and Exhibit 45 provide the estimated GHG reduction impact of each of the two Achievable Potential scenarios.

[27] GHG impacts are estimated based on an emissions factor of 50.7 kg of CO_2e per GJ of natural gas. This is the value currently employed by Natural Resources Canada.

Exhibit 44 Estimated GHG Emission Reductions, By Scenario and Milestone Year (tonnes CO_2e/yr) – Aggressive Achievable Scenario

Year	Lower Mainland	Vancouver Island	Southern Interior	Northern Interior	Whistler	Grand Total
2015	42,613	7,020	7,035	7,974	282	64,924
2020	92,758	16,325	15,927	17,402	620	143,033
2025	150,501	27,939	27,145	28,617	1,021	235,222
2030	213,041	41,776	40,468	41,012	1,468	337,765
Savings 2030 Relative to Total 2030 Savings	63%	12%	12%	12%	0.4%	100%

Exhibit 45 Estimated GHG Emission Reductions, By Scenario and Milestone Year (tonnes CO_2e/yr) – Most Likely Achievable Scenario

Year	Lower Mainland	Vancouver Island	Southern Interior	Northern Interior	Whistler	Grand Total
2015	31,274	4,933	5,321	5,635	206	47,369
2020	65,701	11,108	11,626	12,493	440	101,368
2025	110,366	19,747	19,978	21,209	747	172,047
2030	157,787	30,100	29,865	31,444	1,087	250,283
Savings 2030 Relative to Total 2030 Savings	63%	12%	12%	13%	0.4%	100%

7.4.6 Interpretation of Results

Highlights of the potential natural gas savings presented in the preceding exhibits are summarized below:[28]

Savings by Service Region

The Lower Mainland service region represents approximately 63% of the identified savings in both the *aggressive* and *most likely* Achievable Potential scenarios. Although this magnitude is consistent with the large number of customers in this service region (who constitute approximately 70% of the 2030 Reference Case gas consumption), Achievable savings are slightly lower in the Lower Mainland relative to the 2030 reference than in other regions. This is due to smaller savings for space heating measures in the relatively warm Lower Mainland region.

Savings in the Northern Interior, Southern Interior and Vancouver Island regions each represent between 12% and 13% of the identified savings in both the *most likely* Achievable scenarios. Again, savings relative to the 2030 Reference Case are linked closely to the space heating loads

[28] It should be noted that the approach to Commercial sector segmentation employed in this study differs from that employed in the 2006 CPR. These changes were introduced to better accommodate the scope and objectives of the current study. Of particular importance to any comparison of results, this study includes Medium and Large Apartments in the Commercial sector; the 2006 study included them in the Residential sector. Additionally, this study addresses only those commercial facilities that are FortisBC customers. The 2006 CPR included all commercial facilities within the province, including those that were not FortisBC, then Terasen Gas, customers.

in each region, with the colder Northern Interior region having the largest savings relative to the Reference Case, and the warmer Vancouver Island Region having the smallest relative savings in both Achievable scenarios.

Savings by Milestone Year

In contrast to the Economic Potential scenario, where a large portion of the savings are realized immediately, savings in both Achievable scenarios show a significant increase through time. Based on the adoption patterns estimated by the workshop participants, under the *most likely* scenario, 19% of the 2030 savings would be achieved by 2015, 41% by 2020, and 69% by 2025. In the *aggressive* scenario, 19% would be achieved by 2015, 42% by 2020, and 70% by 2025. While the absolute level of savings differ in the two Achievable scenarios, the rate at which these savings are realized is similar, with the savings being realized in the *aggressive* scenario only slightly more quickly than in the *most likely* scenario.

Savings by Sub Sector

Similar to the results of the Economic Potential scenario, Small Commercial buildings represent approximately 28% of the *most likely* Achievable Potential savings, followed by Apartment buildings at 24%, Hospitals at 8%, Restaurants at just under 7%, and Other Commercial at 7%.

The results of the *aggressive* Achievable Potential scenario are very similar, as Small Commercial buildings represent approximately 28% of the potential savings, followed by Apartment buildings at 24%, Hospitals at almost 8%, and Restaurants & Other Commercial at just over 7%.

Savings by End Use

Similar to the results of the Economic Potential scenario, in the *most likely* Achievable Potential scenario:

- Space heating savings account for approximately 45% of total energy savings.
- DHW savings account for approximately 18% of the total energy savings.
- Cooking savings account for approximately 2% of the total energy savings.
- The remaining savings (35%) are aggregate savings from the two unmodelled sub sectors, Small Commercial and Other Commercial.
- Savings in unmodelled sub sectors are extrapolated based on the results of the modelled sub sectors. Assuming that the savings in the unmodelled sub sectors follow the same end-use pattern as those in the modelled sub sectors, space heating would represent 69% of all savings, with DHW representing 28%.

In the *aggressive* Achievable Potential scenario:

- Space heating savings account for approximately 43% of total energy savings.
- DHW savings account for approximately 20% of the total energy savings.
- Cooking savings account for approximately 2% of the total energy savings.

- The remaining savings (35%) are aggregate savings from the two unmodelled sub sectors, Small Commercial and Other Commercial.
- Savings in unmodelled sub sectors are extrapolated based on the results of the modelled sub sectors. Assuming that the savings in the unmodelled sub sectors follow the same end-use pattern as those in the modelled sub sectors, space heating would represent 65% of all savings, with DHW representing 31%.

In both scenarios, space heating and DHW represent a larger portion of the Achievable savings than they do of Reference Case energy. This illustrates the relative difficulty in realizing savings in more niche end uses, such as commercial cooking.

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9 Glossary

Achievable potential
The Achievable Potential is the proportion of the natural gas savings identified in the Economic Potential Forecast that could realistically be achieved within the study period. Achievable Potential recognizes that it is difficult to induce customers to purchase and install all of the efficiency technologies that meet the criteria defined by the Economic Potential Forecast.

Avoided cost
The unit cost of acquiring the next resource to meet demand, which is used as a measure for evaluating individual demand-side and supply-side options. In the context of this study "avoided cost" is the capital expenditure offset by FortisBC's DSM activities (i.e., the cost of having to buy natural gas on the open market, contract for long-term supply, and the cost of associated transmission and storage.

Base year
The Base Year is the year to which all potentials will be compared. It provides a detailed description of "where" and "how" natural gas is currently used in each sector. For this study, it is the calendar year 2010. The modelled base year energy use is calibrated against FortisBC's actual sales for 2009.

Benefit/cost ratio
The measure benefit/cost ratio indicates the relative attractiveness of the measures. A measure that has a benefit/cost ratio in excess of 1.0 has benefits which outweigh its costs. Similarly, a measure with a benefit/cost ratio that is well in excess of one (e.g., 3.0) means that it is very attractive. A measure with a benefit/cost ratio of less than 1.0 has costs which outweigh its benefits.

Building envelope
The material separation between the interior and the exterior environments of a building. The building envelope serves as the outer shell to protect the indoor environment as well as to facilitate its climate control.

British thermal unit or BTU
The standard measure of heat energy. It takes one Btu to raise the temperature of one pound of water by one degree Fahrenheit at sea level

Co-generation
The simultaneous production of electric or mechanical energy and useful heat energy from a single fuel source.

Combustion efficiency
The ratio of energy released during combustion to the potential chemical energy available in the fuel.

Demand-side management (DSM)
Actions taken by a utility or other agency which are expected to influence the amount or timing of a customers energy consumption.

Discount rate
The interest rate used in calculating the present value of expected yearly benefits and costs.

Economic efficiency
Allocation of human and natural resources in a way that results in the greatest net economic benefit, regardless of how benefits and costs are distributed within society.

Economic potential forecast
The economic potential forecast is an estimate of the level of natural gas consumption that would occur if all equipment and building envelopes were upgraded to the level that is cost effective from society's perspective. All of the energy-efficiency technologies and measures that have a positive measure TRC are incorporated into the economic potential forecast. These technologies and measures are applied at either natural stock turnover rates or at designated years for immediate application.

Energy audit
An on-site inspection and cataloguing of energy using equipment/buildings, energy consumption and the related end-uses. The purpose is to provide information to the customer and the utility. Audits are useful for load research, for DSM program design and for identification of specific energy savings measures.

Energy conservation
Activities by energy users that result in a reduction of the energy used to provide services. Energy conservation can include a wide variety of behavioural or operational changes that result in energy savings..

Energy efficiency
Using less energy to perform the same function.

Energy intensity
The ratio of energy consumed per application or end use. For example, cubic metres per square metre of heated office space per day, or cubic metres per tonne of aluminum produced. All else being equal, energy intensity increases as energy efficiency decreases.

Emerging technologies
New energy-conserving technologies that are not yet market-ready, but may be market-ready over next 5 to 10 years. This category includes technologies that could be accelerated into the market during that period through targeted financial or technical support.

End use
The final application or final use to which energy is applied. End use is often used interchangeably with energy service.

Energy savings
The reduction in use of energy from the pre retrofit baseline to the post retrofit energy use that result from efficient technologies or activities. In this document, the term "energy" refers specifically to energy derived from natural gas unless otherwise noted.

Energy service
An amenity or service supplied jointly by energy and other components/equipment such as buildings and heating equipment. Examples of energy services include residential space heating, commercial cooking, aluminum smelting and public transit. The same energy service can frequently be supplied with different mixes of equipment and energy.

Energy use index (EUI)
End use energy consumption divided by a specific parameter of production (e.g., m^3/unit)
environmental credit/environmental penalty
An increment or decrement to the cost of a resource or set of resources, to reflect the overall level of its/their environmental impact, relative to another resource or set of resources.

Financial incentive
Certain financial features in the utility's DSM programs designed to motivate customer participation. They may include features designed to reduce a customer's net cash outlay, pay-back period or cost of finance to participate.

Fuel share
The proportion of requirements for a specific service that is met using a certain fuel. In the Commercial sector, fuel shares are normalized on a floor area basis. For example, a natural gas fuel share of 90% for space heating in the Large Office sub sector implies that 90% of the sub sector floor space is heated using natural gas.

Free rider
A program participant who would have implemented the program measure or practice in the absence of the program.

Interactive effects
In the context of natural gas use, interactive effects refer to the increase in gas consumed by heating equipment required to offset a decrease in "waste" heat generated by more efficient electrical fixtures or appliances after retrofit or replacement.

Kilowatt (kW)
One thousand watts; the most common unit of measurement of electric power. (The amount of energy transferred at a rate of one kilowatt for one hour is equal to one kilowatt hour.)

Kilowatt hour (kWh)
The most common unit of measurement of electric energy. One kilowatt hour represents the power of one thousand watts for a period of one hour.

Load forecast
An estimate of expected natural gas requirements that have to be met by the utility in future years.

Load research
Research to disaggregate and analyze patterns of natural gas consumption by various subsectors and end-uses. Load Research supports the development of the load forecast and the design of demand-side management programs.

Market transformation
A reduction in market barriers resulting from a market intervention, as evident by a set of market effects that lasts after the intervention has been withdrawn, reduced or changed.

Measure total resource cost (TRC)
The Measure TRC is the net present value of energy savings that result from an investment in a energy efficiency measure. The Measure TRC is equal to its full or incremental capital cost (depending on application) plus any change (positive or negative) in the combined annual energy and operating & maintenance costs. This calculation includes among others, the following inputs: the avoided natural gas, electricity and water; the life of the measure; and the selected discount rate.

Natural conservation
The future change in energy intensity or base usage that is expected to occur in the absence of utility DSM programs. Natural change represents the effects of energy related decisions that would have been made in the absence of the utility programs by both program participants and non-participants

Rate
Generically refers to a utility's rate structure.

Rate structure
The formulae used by a regulated gas utility to calculate charges for the use of natural gas..

Rebates
A type of incentive provided to encourage the adoption of energy efficeing practices, typically paid after the measure has been installed. There are typically two types of rebates: a Prescriptive Rebate, which is a prescribed financial incentive/unit for a prescribed list of products and a customized rebate in which the financial incentive is determined using an analysis of the customer equipment and an agreement on the specific products to be installed.

Reference case forecast
An estimate of the expected level of natural gas consumption that would occur over the study period in the absence of any new utility DSM market interventions after 2010. It is the baseline against which the scenarios of energy savings are calculated. The Reference Case forecast incorporates an estimation of "natural conservation," namely, changes in end-use efficiency over the study period that are projected to occur in the absence of new market interventions by the utility.

Retrofit
Energy efficiency activities undertaken in existing residential or non residential buildings where existing inefficient equipment is replaced by efficient equipment.

Saturation
The portion of floor area that receives a specific energy service. For example, a saturation of 86% for space cooling in the Large Office sub sector means that 86% of the sub sector floor space is cooled (regardless of fuel used to provide that cooling).

Seasonal efficiency
The ratio of delivered useful energy relative to the input potential fuel energy determined over a full heating season (or year).

Sector
A group of customers having a common type of economic activity.

Service area
The portion of the Province of British Columbia that receives service from FortisBC Gas.

Service region
For the purposes of this study, the total FortisBC Gas service area is divided into two service regions. They are the Southern Region and the Eastern Region.

Simple payback
The simple payback is generated to show the customer's financial perspective. Simple payback is a measure of the length of time required for the cumulative savings from a project to recover its initial investment cost, without taking into account the time value of money

Sub sectors
A classification of customers within a sector by common features. Residential subsectors are by type of home (SFD, duplex, apartment, etc.). Commercial subsectors are generally by type of commercial service (office, retail, warehouse, etc.). Industrial subsectors are by product type (pulp and paper, solid wood products, chemicals, etc.).

Supply curves
A curve illustrating the amount of energy (e.g., m^3) or societal benefit available at an appropriate screened price in ascending order of cost.

Total Resource Cost (TRC) Test
A test that compares the total costs of energy efficiency investments, including natural gas conservation programs, to the social cost of natural gas. Un-priced environmental and social costs may be accounted for by changing the cost of either the investment under consideration or the total cost of natural gas in such a way that relative un-priced impacts are reflected. It is used in designing and evaluating programs that are developed from the Energy Efficiency Potential study's results.

Utility cost
The total financial cost incurred by the utility to acquire energy resources. For DSM, the costs include all utility program costs, including incentive costs.

Watt
The basic unit of measurement of power, at a point in time as capacity or demand.

Marbek

CONSERVATION POTENTIAL REVIEW-2010 FortisBC

Commercial Sector

Energy-efficiency & Alternative Energy Opportunities

APPENDICES

Submitted to
FortisBC

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Appendix A Background – Section 3: Base Year Natural Gas Use

Introduction

Appendix A provides additional detailed information related to the generation of the Commercial sector Base Year profile. The appendix discusses the following:

- Sub sector descriptions
- Base Year details – Vancouver Island, Southern Interior and Northern Interior regions
- CEEAM Archetype summaries – Existing Buildings.

A1 Sub Sector Descriptions

Exhibit 46 presents brief descriptions of the Commercial sub sectors. Detailed building archetype profiles for each sub sector are provided in Appendix A3 (Existing buildings) and Appendix B2 (New Buildings).

Exhibit 46 Sub sector Descriptions

	Building Category	Definition	Examples of Building Types
1	Office	Buildings used for office or public administration.	Municipal office, government office building, private office buildings
2	Non-Food Retail	Retail store that primarily sells non-food items	"Big box" store, strip mall, enclosed mall unit
3	Food Retail	Retail store that primarily sells food items and has a significant refrigeration load.	Supermarket
4	Hotel	Hotel or motel building.	
5	Hospital	Hospital or other large, intensive healthcare building.	
6	Nursing Home	Buildings used for providing multiple accommodations for long-term care residents.	Long-term care facility, retirement home, nursing home
7	School	Elementary or Secondary school, typically with seasonal occupancy.	
8	University/College	Post-secondary institution, typically including laboratories, dormitories and less seasonal variation in occupancy than primary/secondary schools.	
9	Restaurant	Full service or quick service restaurant	
10	Warehouse / Wholesale	Typically metal-clad building with high ceilings and predominantly high-bay lighting.	
11	Apartment	Residential building with 5 or more units	
12	Recreation and Other	Commercial or institutional buildings which do not fit into one of the above categories	Service garages, religious buildings, theatres, prisons.

A2 Base Year Details – Vancouver Island, Southern Interior and Northern Interior Regions

Exhibit 47 Natural Gas Shares by Area and Sub Sector (%)

	Vancouver Island		Southern Interior		Northern Interior	
Sub Sector	**Space Heating**	**DHW**	**Space Heating**	**DHW**	**Space Heating**	**DHW**
Large Office	95%	60%	95%	60%	95%	60%
Medium Office	90%	60%	90%	60%	90%	60%
Large Non-food Retail	90%	50%	90%	50%	90%	50%
Medium Non-food Retail	89%	45%	89%	45%	89%	45%
Food Retail	90%	65%	90%	65%	90%	65%
Large Hotel	85%	90%	85%	90%	85%	90%
Medium Hotel	60%	70%	60%	70%	60%	70%
Hospital	95%	90%	95%	90%	95%	90%
Nursing Home	90%	70%	90%	70%	90%	70%
Large School	94%	70%	94%	70%	94%	70%
Medium School	94%	70%	94%	70%	94%	70%
University/College	95%	85%	95%	85%	95%	85%
Restaurant	87%	60%	87%	60%	87%	60%
Warehouse/Wholesale	88%	50%	88%	50%	88%	50%
Large Apartment	85%	75%	85%	75%	85%	75%
Medium Apartment	80%	70%	80%	70%	80%	70%

Exhibit 48 Space heating equipment shares by Area and Sub Sector (% of Natural Gas Heated Floor Area)

Boiler	Vancouver Island			Southern Interior			Northern Interior		
	Boiler	Rooftop Unit	Other	Boiler	Rooftop Unit	Other	Boiler	Rooftop Unit	Other
Large Office	89%	11%	0%	89%	11%	0%	89%	11%	0%
Medium Office	50%	50%	0%	50%	50%	0%	50%	50%	0%
Large Non-food Retail	22%	67%	11%	22%	67%	11%	22%	67%	11%
Medium Non-food Retail	10%	62%	28%	10%	62%	28%	10%	62%	28%
Food Retail	10%	62%	28%	10%	62%	28%	10%	62%	28%
Large Hotel	79%	21%	0%	79%	21%	0%	79%	21%	0%
Medium Hotel	50%	50%	0%	50%	50%	0%	50%	50%	0%
Hospital	89%	11%	0%	89%	11%	0%	89%	11%	0%
Nursing Home	83%	11%	6%	83%	11%	6%	83%	11%	6%
Large School	77%	11%	13%	77%	11%	13%	77%	11%	13%
Medium School	77%	11%	13%	77%	11%	13%	77%	11%	13%
University/College	89%	11%	0%	89%	11%	0%	89%	11%	0%
Restaurant	5%	55%	40%	5%	55%	40%	5%	55%	40%
Warehouse/Wholesale	9%	40%	51%	9%	40%	51%	9%	40%	51%
Large Apartment	71%	24%	6%	71%	24%	6%	71%	24%	6%
Medium Apartment	56%	25%	19%	56%	25%	19%	56%	25%	19%

Exhibit 49 Base Year Floor Area by Service Area and Sub Sector (m^2)

Sub Sector	Lower Mainland	Vancouver Island	Southern Interior	Northern Interior	Total FortisBC Service Area
Large Office	2,853,587	770,412	394,103	140,766	4,158,868
Medium Office	1,482,179	297,035	273,862	156,971	2,210,047
Large Non-food Retail	3,380,852	85,519	396,407	193,039	4,055,816
Medium Non-food Retail	1,997,727	123,825	259,075	139,901	2,520,528
Food Retail	476,237	299,862	101,704	45,566	923,369
Large Hotel	724,240	172,669	195,706	60,499	1,153,115
Medium Hotel	387,211	71,501	162,415	89,128	710,255
Hospital	1,302,501	367,019	249,127	124,236	2,042,883
Nursing Home	1,262,027	234,184	329,950	83,126	1,909,287
Large School	2,857,352	667,447	438,989	153,799	4,117,587
Medium School	1,602,266	572,471	342,890	167,987	2,685,613
University/College	3,869,828	674,878	136,089	187,813	4,868,608
Restaurant	1,740,290	220,592	228,340	134,878	2,324,101
Warehouse/Wholesale	598,670	135,715	33,047	49,087	816,519
Large Apartment	15,421,251	656,974	366,631	188,598	16,633,453
Medium Apartment	9,147,687	512,122	319,423	163,617	10,142,849
Total	49,103,905	5,862,226	4,227,757	2,079,011	61,272,899
%	80.1%	9.6%	6.9%	3.4%	100.0%

Exhibit 50 Natural Gas Consumption for Vancouver Island by End Use, Base Year (GJ/yr.)

Sub Sector	Commercial Cooking	Domestic Hot Water	Space Heating	Other	Grand Total
Large Office	7,704	27,058	229,067	15,408	279,238
Medium Office	2,970	9,357	101,346	5,941	119,614
Large Non-food Retail	855	2,201	26,394	428	29,878
Medium Non-food Retail	2,476	2,901	40,133	1,238	46,749
Food Retail	23,989	20,745	101,702	5,997	152,433
Large Hotel	17,267	50,521	48,712	10,360	126,860
Medium Hotel	4,290	17,092	20,303	4,290	45,975
Hospital	25,691	105,420	301,939	91,755	524,806
Nursing Home	14,051	38,993	89,426	16,393	158,863
Large School	13,349	27,254	184,722	3,337	228,662
Medium School	5,725	23,376	215,574	2,862	247,537
University/College	26,995	50,508	250,279	47,241	375,024
Restaurant	198,533	113,448	79,157	4,412	395,550
Warehouse/Wholesale	679	2,586	31,111	2,714	37,090
Large Apartment	6,570	137,506	190,685	26,279	361,040
Medium Apartment	2,561	95,093	142,459	15,364	255,476
Small Commercial	-	-	-	-	1,759,824
Recreation Facilities and Other	-	-	-	-	1,124,436
Total	**353,705**	**724,059**	**2,053,008**	**254,020**	**6,269,053**

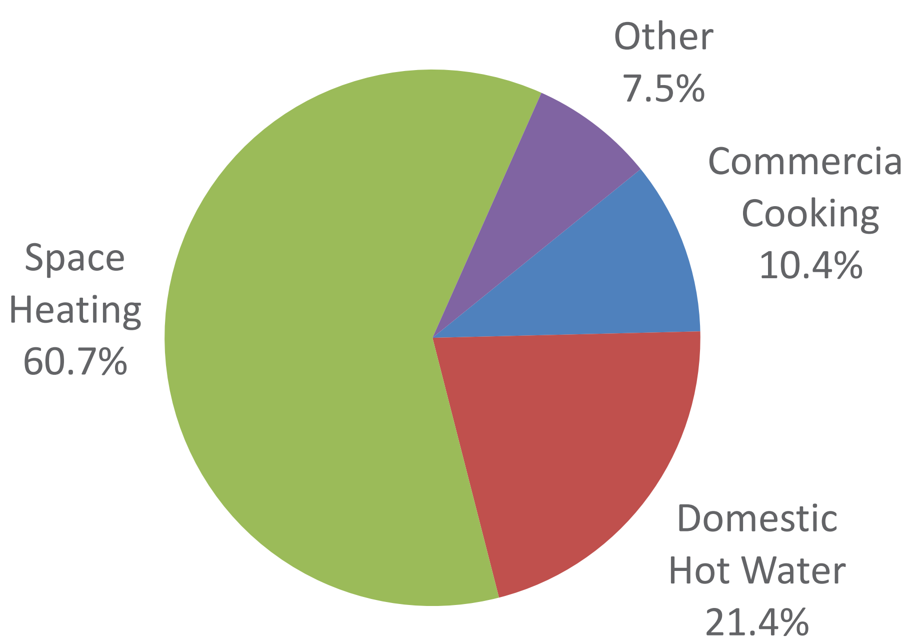


Exhibit 51 Natural Gas Consumption for Northern Interior by End Use, Base Year (GJ/yr.)

Sub Sector	Commercial Cooking	Domestic Hot Water	Space Heating	Other	Grand Total
Large Office	1,408	4,944	74,722	2,815	83,889
Medium Office	1,570	4,945	89,844	3,139	99,498
Large Non-food Retail	1,930	4,968	82,846	965	90,709
Medium Non-food Retail	2,798	3,278	61,887	1,399	69,362
Food Retail	3,645	3,152	34,165	911	41,874
Large Hotel	6,050	17,701	31,640	3,630	59,021
Medium Hotel	5,348	21,305	40,652	5,348	72,652
Hospital	8,696	35,685	291,608	31,059	367,048
Nursing Home	4,988	13,841	73,576	5,819	98,223
Large School	3,076	6,280	114,648	769	124,773
Medium School	1,680	6,859	113,147	840	122,526
University/College	7,513	14,056	174,368	13,147	209,084
Restaurant	121,391	69,366	183,246	2,698	376,700
Warehouse/Wholesale	245	935	26,155	982	28,317
Large Apartment	1,886	39,474	81,911	7,544	130,815
Medium Apartment	818	30,381	67,243	4,908	103,351
Small Commercial	-	-	-	-	2,260,496
Recreation Facilities and Other	-	-	-	-	325,791
Total	173,041	277,171	1,541,658	85,973	4,664,130

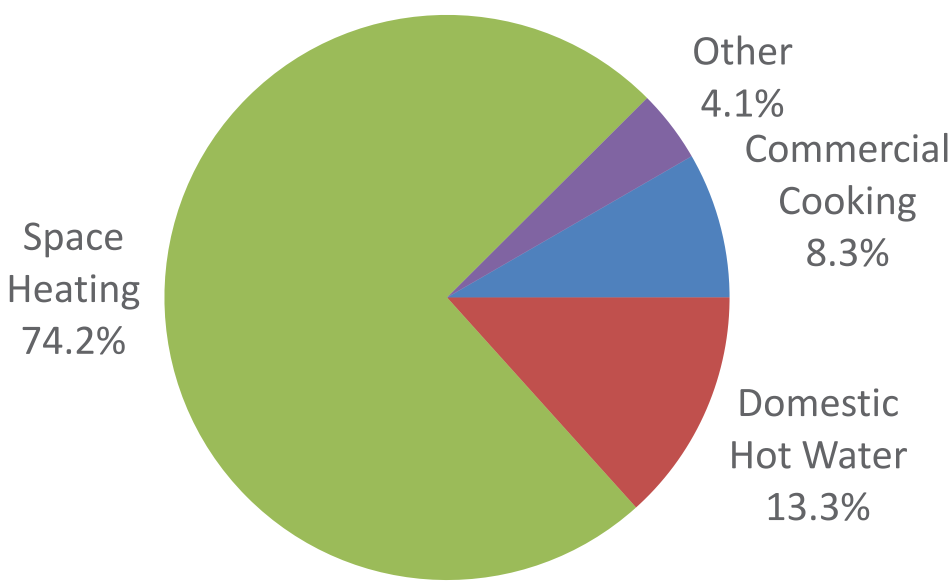
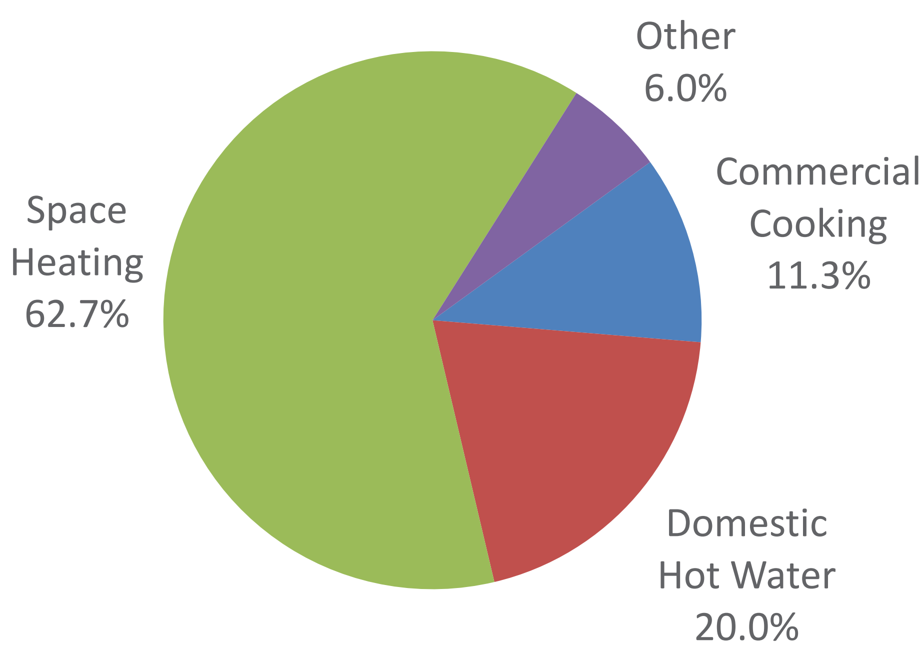


Exhibit 52 Natural Gas Consumption for Southern Interior by End Use, Base Year (GJ/yr.)

Sub Sector	Commercial Cooking	Domestic Hot Water	Space Heating	Other	Grand Total
Large Office	3,941	13,842	139,920	7,882	165,585
Medium Office	2,739	8,627	108,433	5,477	125,275
Large Non-food Retail	3,964	10,202	147,052	1,982	163,200
Medium Non-food Retail	5,181	6,070	100,526	2,591	114,369
Food Retail	8,136	7,036	33,372	2,034	50,579
Large Hotel	19,571	57,261	69,044	11,742	157,618
Medium Hotel	9,745	38,824	52,675	9,745	110,988
Hospital	17,439	71,558	291,662	62,282	442,940
Nursing Home	19,797	54,938	140,766	23,097	238,597
Large School	8,780	17,925	140,988	2,195	169,888
Medium School	3,429	14,001	147,684	1,714	166,829
University/College	5,444	10,185	58,558	9,526	83,713
Restaurant	205,506	117,432	96,518	4,567	424,022
Warehouse/Wholesale	165	630	9,123	661	10,579
Large Apartment	3,666	76,737	126,991	14,665	222,060
Medium Apartment	1,597	59,312	106,172	9,583	176,664
Small Commercial	-	-	-	-	2,414,086
Recreation Facilities and Other	-	-	-	-	429,976
Grand Total	319,100	564,579	1,769,484	169,743	5,666,967



A3 CEEAM Archetype Summaries – Existing Buildings

This section includes summary profiles of the 64 existing building archetypes constructed for this study. Exhibit 53 provides definitions for and explanations of various terms used within the CEEAM profiles, while Exhibit 54 presents a table of contents for the CEEAM building profiles that follow.

Exhibit 53 Terminology used in CEEAM Building Profiles

Profile Term	Explanation
Building Envelope	Defines the thermal characteristics of a building's exterior components
U-value	The rate of heat loss, in Btu per hour per square foot per degree Fahrenheit (BTU/hr. f^2.°F) through walls, roofs and windows. The U-value is the reciprocal of the R-value
Shading coefficient (SC)	Is a measure of the total amount of heat passing through the glazing compared with that through a single clear glass
Window-to-wall ratio	Defines the ratio of window to insulated exterior wall area
General Lighting	Defines the lighting types that are used within the main areas of a building, e.g., for a school, the area is classrooms and the lighting type is fluorescent; for a Food Retail store, the main area is the retail floor.
LPD	Lighting power density expressed in terms of W/ft^2
Lux	The amount of visible light per square meter incident on a surface (lumen/m^2)
Inc	Incandescent lamps
CFL	Compact fluorescent lamps
T12	T12 fluorescent lamps with magnetic ballasts
T8	T8 fluorescent lamps with electronic ballasts
MH	Metal halide lamps
HPS	High-pressure sodium lamps
HID	High-intensity discharge lighting includes both MH and HPS
Secondary Lighting	Defines the lighting types that are used within the secondary areas of a building, e.g., for a school, the secondary areas are corridors, lobbies, foyers, etc.,
Tertiary Lighting	Defines the lighting types that are used within special purpose areas of a building, e.g., for a school, the tertiary area is a gymnasium.
Outdoor Lighting	Defines the outdoor lighting including parking lot and façade
Overall LPD	The total floor weighted LPD that includes general, secondary, tertiary, and outdoor.
Fans	Defines mix of air handling systems
CAV	Constant air volume
VAV	Variable air volume
Space Heating	Defines the mix of heating equipment types found within the stock of buildings
ASHP	Air source heat pump
WSHP	Water source heat pump
Resistance	Electric resistance heating equipment including boilers and baseboard heaters
Natural Gas	Natural gas heating equipment including packaged rooftop units and boilers
Space Cooling	Defines the mix of cooling equipment types found within the stock of buildings
Centrifugal	Standard centrifugal chillers with a full load performance of 0.75 kW/ton
Centri HE	High-efficiency centrifugal chillers assumed to have a performance of <0.65 kW/ton
Recip Open	Semi-hermetic reciprocating chillers
DX	Direct expansion cooling equipment that use small tonnage hermetic R-22 compressors

Exhibit 54 Table of Contents - Existing CEEAM Building Profiles

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **Large Office** **Baseline**

SIZE: **> 9,300 m² (100,000 ft²)**

VINTAGE:

REGION: **Lower Mainland**

CONSTRUCTION

Wall U value (W/m².°C)	0.91	W/m².°C	0.16	Btu/hr.ft² . °F
Roof U value (W/m².°C)	0.61	W/m².°C	0.11	Btu/hr.ft² . °F
Glazing U value (W/m².°C)	4.29	W/m².°C	0.75	Btu/hr.ft² . °F
Window/Wall Ratio (WIWAR) (%)	0.41			
Shading Coefficient (SC)	0.58			

Typical Building Size	21,365	m²	229,887	ft²
Typical Footprint (m²)	1,526	m²	16,421	ft²
Footprint Aspect Ratio (L:W)	1			
Percent Conditioned Space	100%			
Percent Conditioned Space Defined as Exterior Zone	45%			
Typical # Stories	14			
Floor to Floor Height (m)	3.7	m	12.0	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	50%		0%		50%		0%		100%
Min. Air Flow (%)					40%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	26	m²/person	274	ft²/person
Occupancy Schedule Occ. Period	90%			
Occupancy Schedule Unocc. Period	0%			
Fresh Air Requirements or Outside Air	20	L/s.person	42	CFM/person

%OA 15.43%

Fresh Air Control Type *(enter a 1, 2 or 3) 1
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right:
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation — L/s.m² — 0.00 CFM/ft² — operation (%)

Sizing Factor	1.6			
Total Air Circulation or Design Air Flow	5.08	L/s.m²	1.00	CFM/ft²
Infiltration Rate	0.70	L/s.m²	0.14	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA) — L/s.m² — 0.00 CFM/ft²
Operation occupied period 50%
Operation unoccupied period 50%

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	6,571,023	
Peak Zone Sensible Load	3,092,263	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	143,852	
Total air circulation or Design air	5.08	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	24	°C	75.2	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				98%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	19.5	°C	67.1	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning — Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Office	> 9,300 m² (100,000 ft²)		Lower Mainland
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	600	Lux	55.8	ft-candles
Floor Fraction (GLFF)	0.90			
Connected Load	16.6	W/m²	1.5	W/ft²
Occ. Period(Hrs./yr.)	2900			
Unocc. Period(Hrs./yr.)	5860			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	35%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	500	600	700	800	Total
% Distribution	25%	50%	25%	0%	100%
Weighted Average					**600**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			37.5%	0%	62.5%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	6.7
	MJ/m².yr	259

ARCHITECTURAL LIGHTING

Light Level	350	Lux	32.5	ft-candles
Floor Fraction (ALFF)	0.10			
Connected Load	29.7	W/m²	2.8	W/ft²
Occ. Period(Hrs./yr.)	3400			
Unocc. Period(Hrs./yr.)	5360			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	50%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	200	300	400	500	Total
% Distribution	10%	40%	40%	10%	100%
Weighted Average					**350**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	40%	60%					0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	1.6
	MJ/m².yr	63

SPECIAL PURPOSE LIGHTING

Light Level	0.00	Lux	0.0	ft-candles
Floor Fraction (HBLFF)	0.00			
Connected Load	0.0	W/m²	0.0	W/ft²
Occ. Period(Hrs./yr.)	4000			
Unocc. Period(Hrs./yr.)	4760			
Usage During Occupied Period	0%			
Usage During Unoccupied Period	100%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 | 1.00

Light Level (Lux)	300	500	700	1000	Total
% Distribution		0%	0%	0%	0%
Weighted Average					**0**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)								0.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	0.0
	MJ/m².yr	0

TOTAL LIGHTING

Overall LPD	17.94 W/m²	EUI TOTAL	kWh/ft².yr	8.3
	1.67 W/ft²		MJ/m².yr	322

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Servers	Plug Loads
Measured Power (W/device)	55	51	100	200	217	
Density (device/occupant)	0.9	0.9	0.15	0.1	0.06	
Connected Load	1.9 W/m²	1.8 W/m²	0.6 W/m²	0.8 W/m²	0.5 W/m²	2.5 W/m²
	0.2 W/ft²	0.2 W/ft²	0.05 W/ft²	0.07 W/ft²	0.05 W/ft²	0.23 W/ft²
Diversity Occupied Period	90%	90%	90%	90%	100%	90%
Diversity Unoccupied Period	50%	50%	50%	50%	100%	25%
Operation Occ. Period (hrs./year)	2500	2500	2500	2500	2500	3000
Operation Unocc. Period (hrs./year)	6260	6260	6260	6260	6260	5760

Total end-use load (occupied period)	7.3 W/m²	0.7 W/ft²
Total end-use load (unocc. period)	3.7 W/m²	0.3 W/ft²
Usage during occupied period	100%	
Usage during unoccupied period	50%	

Computer Equipment	EUI	kWh/ft².yr	2.96
		MJ/m².yr	114.76
Plug Loads	EUI	kWh/ft².yr	0.96
		MJ/m².yr	37.26

FOOD SERVICE EQUIPMENT

Provide description below:

Cafeteria

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	0.3	EUI	kWh/ft².yr	0.1
	MJ/m².yr	10.0		MJ/m².yr	3.0

REFRIGERATION

Provide description below:

Cafeteria

EUI	kWh/ft².yr	0.1
	MJ/m².yr	4.0

MISCELLANEOUS

Provide description below:

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	0.5	EUI	kWh/ft².yr	0.0
	MJ/m².yr	20.0		MJ/m².yr	0.0

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **Large Office** **Baseline**

SIZE: **> 9,300 m² (100,000 ft²)**

VINTAGE:

REGION: **Lower Mainland**

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	65%	15%	5%	10%	0%	0%	1%	1%	3%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff.) (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load: 33.9 W/m² — 10.7 Btu/hr.ft²
Seasonal Heating Load (Tertiary Load): 228 MJ/m².yr — 5.9 kWh/ft².yr
Sizing Factor: 1.00

Electric Fuel Share: 5.0% — Fossil Fuel Share: 95.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	4.6
MJ/m².yr	178

Gas EUI	
kWh/ft².yr	7.7
MJ/m².yr	298

Market Composite EUI	
kWh/ft².yr	7.5
MJ/m².yr	292

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	56.0%	24.0%		5.0%	15.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7	°C	44.6	°F
Condenser Water	30	°C	86	°F
Supply Air	14.0	°C	57.2	°F

Peak Cooling Load: 90 W/m² — 29 Btu/hr.ft² — 420 ft²/Ton
Seasonal Cooling Load (Tertiary Load): 188.2 MJ/m².yr — 4.9 kWh/ft².yr

Sizing Factor: 1.00 — Operation (occ. period) 3000 hrs/year — Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C): 90.0%

Electric Fuel Share: 100.0% — Gas Fuel Share: 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenan

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	1.7
MJ/m².yr	67

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	1.7
MJ/m².yr	67

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	40%				20%
Eff./COP	0.65				0.75

	Fossil		Elec. Res.
Fuel Share	60%		40%
Blended Efficiency	0.68		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load): 40.0

Wetting Use Percentage: 90%

All Electric EUI	
kWh/ft².yr	1.1
MJ/m².yr	44

Fossil Fuel EUI	
kWh/ft².yr	1.5
MJ/m².yr	59

Market Composite EUI	
kWh/ft².yr	1.4
MJ/m².yr	52.7

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Office	> 9,300 m² (100,000 ft²)		Lower Mainland
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	5.1	L/s.m²	1.00	CFM/ft²
System Static Pressure CAV	875	Pa	3.5	wg
System Static Pressure VAV	875	Pa	3.5	wg
Fan Efficiency	52%			
Fan Motor Efficiency	90%			
Sizing Factor	1.00			
Fan Design Load CAV	9.5	W/m²	0.88	W/ft²
Fan Design Load VAV	9.5	W/m²	0.88	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	50%	50%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	50%	50%	50%	50%
Comments:				

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m²	0.03	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.2	L/s.m²	0.05	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	40%			
Fan Motor Efficiency	80%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.2	W/m²	0.02	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.020	kW/kW	0.07	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	1.80	W/m²	0.17	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.005	L/s.m²	0.007	U.S. gpm/ft²
Pump Head Pressure	90	kPa	30	ft
Pump Efficiency	55%			
Pump Motor Efficiency	90%			
Sizing Factor	1.0			
Pump Connected Load	0.87	W/m²	0.08	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.004	L/s.m²	0.0057	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	150	kPa	50	ft		
Pump Efficiency	55%					
Pump Motor Efficiency	90%					
Sizing Factor	0.8					
Pump Connected Load	0.9	W/m²	0.09	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	46.0	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	1.1	kWh/m².yr
Condenser Pump Energy Consumption	2.9	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	1.0	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	4.7	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI		
	kWh/ft².yr	5.2
	MJ/m².yr	200.3

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Large Office	**> 9,300 m² (100,000 ft²)**		**Lower Mainland**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**20.7** kWh/ft².yr	**800.6** MJ/m².yr	**Fossil Fuel**	**9.0** kWh/ft².yr	**348.0** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	6.7	259.0
ARCHITECTURAL LIGHTING	1.6	63.3
SPECIAL PURPOSE LIGHTING	0.0	0.0
OTHER PLUG LOADS	1.0	37.3
HVAC FANS & PUMPS	5.2	200.3
REFRIGERATION	0.1	4.0
COMPUTER EQUIPMENT	3.0	114.8
ELEVATORS	0.4	15.5
OUTDOOR LIGHTING	0.4	17.0

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.2	8.9	7.3	282.9
SPACE COOLING	1.5	60.0	0.0	0.0
DOMESTIC HOT WATER	0.5	17.6	0.9	35.1
FOOD SERVICE EQUIPMENT	0.1	3.0	0.3	10.0
MISCELLANEOUS	0.0	0.0	0.5	20.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Medium Office	**50,000 to 100,000 ft²**		**Lower Mainland**
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.88	W/m².°C	0.15	Btu/hr.ft² . °F	Typical Building Size	6,777	m²	72,921	ft²
Roof U value (W/m².°C)	0.61	W/m².°C	0.11	Btu/hr.ft² . °F	Typical Footprint (m²)	753	m²	8,102	ft²
Glazing U value (W/m².°C)	4.29	W/m².°C	0.75	Btu/hr.ft² . °F	Footprint Aspect Ratio (L:W)	1			
					Percent Conditioned Space	100%			
					Percent Conditioned Space Defined as Exterior Zone	45%			
Window/Wall Ratio (WIWAR) (%)	0.36								
Shading Coefficient (SC)	0.58				Typical # Stories	9			
					Floor to Floor Height (m)	3.7	m	12.0	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	75%		0%		25%		0%		100%
Min. Air Flow (%)					60%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	26	m²/person	274	ft²/person	%OA	12.08%
Occupancy Schedule Occ. Period	90%					
Occupancy Schedule Unocc. Period	0%					
Fresh Air Requirements or Outside Air	15	L/s.person	32	CFM/person		

Fresh Air Control Type *(enter a 1, 2 or 3) | 1 | If Fresh Air Control Type = "2" enter % FA. to the right:
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air) | If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation | L/s.m² | 0.00 CFM/ft² | operation (%)

Sizing Factor	1.5			
Total Air Circulation or Design Air Flow	4.87	L/s.m²	0.96	CFM/ft²
Infiltration Rate	0.70	L/s.m²	0.14	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)		L/s.m²	0.00 CFM/ft²
Operation occupied period	50%		
Operation unoccupied period	50%		

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	1,844,722	
Peak Zone Sensible Load	1,001,874	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	46,607	
Total air circulation or Design air	4.87	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	24	°C	75.2	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				98%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	19.5	°C	67.1	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning — Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Office	**50,000 to 100,000 ft^2**		**Lower Mainland**
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	600	Lux	55.8	ft-candles
Floor Fraction (GLFF)	0.92			
Connected Load	16.6	W/m^2	1.5	W/ft^2
Occ. Period(Hrs./yr.)	2900			
Unocc. Period(Hrs./yr.)	5860			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	30%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	500	600	700	800	Total
% Distribution	25%	50%	25%	0%	100%
Weighted Average					**600**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			37.5%		62.5%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI		
	$kWh/ft^2.yr$	6.4
	$MJ/m^2.yr$	249

ARCHITECTURAL LIGHTING

Light Level	350	Lux	32.5	ft-candles
Floor Fraction (ALFF)	0.07			
Connected Load	31.5	W/m^2	2.9	W/ft^2
Occ. Period(Hrs./yr.)	3400			
Unocc. Period(Hrs./yr.)	5360			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	40%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	200	300	400	500	Total
% Distribution	10%	40%	40%	10%	100%
Weighted Average					**350**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	45%	55%					0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI		
	$kWh/ft^2.yr$	1.1
	$MJ/m^2.yr$	43

SPECIAL PURPOSE LIGHTING

Light Level	0.00	Lux	0.0	ft-candles
Floor Fraction (HBLFF)	0.01			
Connected Load	0.0	W/m^2	0.0	W/ft^2
Occ. Period(Hrs./yr.)	3400			
Unocc. Period(Hrs./yr.)	5360			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	40%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 | 1.00

Light Level (Lux)	300	500	700	1000	Total
% Distribution		0%	0%	0%	0%
Weighted Average					**0**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)						50%	50%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI		
	$kWh/ft^2.yr$	0.0
	$MJ/m^2.yr$	0

TOTAL LIGHTING

Overall LPD	17.51 W/m^2	EUI TOTAL	$kWh/ft^2.yr$	7.5
	1.63 W/ft^2		$MJ/m^2.yr$	291

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Servers	Plug Loads
Measured Power (W/device)	55	51	100	200	217	
Density (device/occupant)	0.9	0.9	0.15	0.1	0.06	
Connected Load	1.9 W/m^2	1.8 W/m^2	0.6 W/m^2	0.8 W/m^2	0.5 W/m^2	1 W/m^2
	0.2 W/ft^2	0.2 W/ft^2	0.05 W/ft^2	0.07 W/ft^2	0.05 W/ft^2	0.09 W/ft^2
Diversity Occupied Period	90%	90%	90%	90%	100%	80%
Diversity Unoccupied Period	50%	50%	50%	50%	100%	25%
Operation Occ. Period (hrs./year)	2500	2500	2500	2500	2500	2500
Operation Unocc. Period (hrs./year)	6260	6260	6260	6260	6260	6260

Total end-use load (occupied period)	5.9 W/m^2	0.5 W/ft^2
Total end-use load (unocc. period)	3.3 W/m^2	0.3 W/ft^2
Usage during occupied period	100%	
Usage during unoccupied period	56%	

	EUI		
Computer Equipment	EUI	$kWh/ft^2.yr$	2.96
		$MJ/m^2.yr$	114.76
Plug Loads	EUI	$kWh/ft^2.yr$	0.33
		$MJ/m^2.yr$	12.83

FOOD SERVICE EQUIPMENT

Provide description below:

Lunch room/cafeteria/restaurant

	Gas EUI			Electric EUI	
EUI	$kWh/ft^2.yr$	0.3	EUI	$kWh/ft^2.yr$	0.1
	$MJ/m^2.yr$	10.0		$MJ/m^2.yr$	4.0

REFRIGERATION

Provide description below:

Lunch room/cafeteria/restaurant

EUI		
	$kWh/ft^2.yr$	0.1
	$MJ/m^2.yr$	4.0

MISCELLANEOUS

Provide description below:

	Gas EUI			Electric EUI	
EUI	$kWh/ft^2.yr$	0.5	EUI	$kWh/ft^2.yr$	0.0
	$MJ/m^2.yr$	20.0		$MJ/m^2.yr$	0.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Medium Office	**50,000 to 100,000 ft²**		**Lower Mainland**
Baseline			

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	30%	10%	5%	45%	0%	0%	3%	1%	6%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff.) (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	37.2 W/m²	11.8 Btu/hr.ft²	
Seasonal Heating Load (Tertiary Load)	276 MJ/m².yr	7.1 kWh/ft².yr	
Sizing Factor	1.00		
Electric Fuel Share	10.0%	Fossil Fuel Share	90.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	5.8
MJ/m².yr	224

Gas EUI	
kWh/ft².yr	9.3
MJ/m².yr	362

Market Composite EUI	
kWh/ft².yr	9.0
MJ/m².yr	348

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	5.0%	5.0%	10.0%	30.0%	50.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7 °C	44.6 °F
Condenser Water	30 °C	86 °F
Supply Air	14.0 °C	57.2 °F

Peak Cooling Load	80 W/m²	25 Btu/hr.ft²	474 ft²/Ton
Seasonal Cooling Load (Tertiary Load)	163.9 MJ/m².yr	4.2 kWh/ft².yr	

Sizing Factor: 1.00 — Operation (occ. period): 3000 hrs/year — Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C): 90.0%

Electric Fuel Share: 100.0% — Gas Fuel Share: 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	1.8
MJ/m².yr	70

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	1.8
MJ/m².yr	70

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	50%				10%
Eff./COP	0.65				0.75

	Fossil	Elec. Res.
Fuel Share	60%	40%
Blended Efficiency	0.67	0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load): 35.0

Wetting Use Percentage: 90%

All Electric EUI	
kWh/ft².yr	1.0
MJ/m².yr	38

Fossil Fuel EUI	
kWh/ft².yr	1.4
MJ/m².yr	53

Market Composite EUI	
kWh/ft².yr	1.2
MJ/m².yr	46.9

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Medium Office	**50,000 to 100,000 ft²**		**Lower Mainland**
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	4.9	L/s.m²	0.96	CFM/ft²
System Static Pressure CAV	750	Pa	3.0	wg
System Static Pressure VAV	750	Pa	3.0	wg
Fan Efficiency	52%			
Fan Motor Efficiency	85%			
Sizing Factor	1.00			
Fan Design Load CAV	8.3	W/m²	0.77	W/ft²
Fan Design Load VAV	8.3	W/m²	0.77	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	75%	25%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	75%	25%	75%	25%
Comments:				

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.3	L/s.m²	0.05	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.4	L/s.m²	0.07	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	40%			
Fan Motor Efficiency	80%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.3	W/m²	0.03	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.018	kW/kW	0.06	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	1.43	W/m²	0.13	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.004	L/s.m²	0.006	U.S. gpm/ft²
Pump Head Pressure	90	kPa	30	ft
Pump Efficiency	55%			
Pump Motor Efficiency	90%			
Sizing Factor	1.0			
Pump Connected Load	0.77	W/m²	0.07	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.003	L/s.m²	0.0051	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	150	kPa	50	ft		
Pump Efficiency	55%					
Pump Motor Efficiency	90%					
Sizing Factor	0.5					
Pump Connected Load	0.5	W/m²	0.05	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	57.1	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	2.1	kWh/m².yr
Condenser Pump Energy Consumption	1.1	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.8	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	2.6	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI	kWh/ft².yr	5.9
	MJ/m².yr	229.5

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Medium Office	**50,000 to 100,000 ft²**		**Lower Mainland**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**20.3** kWh/ft².yr	**785.7** MJ/m².yr	**Fossil Fuel**	**10.0** kWh/ft².yr	**387.4** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	6.4	248.6
ARCHITECTURAL LIGHTING	1.1	42.7
SPECIAL PURPOSE LIGHTING	0.0	0.0
OTHER PLUG LOADS	0.3	12.8
HVAC FANS & PUMPS	5.9	229.5
REFRIGERATION	0.1	4.0
COMPUTER EQUIPMENT	3.0	114.8
ELEVATORS	0.3	11.6
OUTDOOR LIGHTING	0.4	17.0

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.6	22.4	8.4	325.9
SPACE COOLING	1.6	63.0	0.0	0.0
DOMESTIC HOT WATER	0.4	15.4	0.8	31.5
FOOD SERVICE EQUIPMENT	0.1	4.0	0.3	10.0
MISCELLANEOUS	0.0	0.0	0.5	20.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Retail	> 100,000 ft^2		Lower Mainland
Baseline			

CONSTRUCTION

Wall U value (W/m^2.°C)	0.73 W/m^2.°C	0.13 Btu/hr.ft^2 . °F	Typical Building Size	24,000 m^2	258,240 ft^2
Roof U value (W/m^2.°C)	0.61 W/m^2.°C	0.11 Btu/hr.ft^2 . °F	Typical Footprint (m^2)	24,000 m^2	258,240 ft^2
Glazing U value (W/m^2.°C)	4.82 W/m^2.°C	0.85 Btu/hr.ft^2 . °F	Footprint Aspect Ratio (L:W)	15	
			Percent Conditioned Space	100%	
			Percent Conditioned Space Defined as Exterior Zone	40%	
Window/Wall Ratio (WIWAR) (%)	0.10				
Shading Coefficient (SC)	0.75		Typical # Stories	1	
			Floor to Floor Height (m)	4.6 m	15.0 ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	95%		0%		5%		0%		100%
Min. Air Flow (%)					60%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	45 m^2/person	484 ft^2/person	%OA 17.66%
Occupancy Schedule Occ. Period	90%		
Occupancy Schedule Unocc. Period	0%		
Fresh Air Requirements or Outside Air	40 L/s.person	85 CFM/person	

Fresh Air Control Type *(enter a 1, 2 or 3): 1
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right: 0%
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation: 0.5 L/s.m^2 | 0.10 CFM/ft^2 | 50% operation (%)

Sizing Factor	1.8	
Total Air Circulation or Design Air Flow	5.03 L/s.m^2	0.99 CFM/ft^2
Infiltration Rate	0.70 L/s.m^2	0.14 CFM/ft^2

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0 L/s.m^2	0.00 CFM/ft^2
Operation occupied period	50%	
Operation unoccupied period	50%	

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	7,362,838	
Peak Zone Sensible Load	3,056,393	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft^3/lbm
Design CFM	142,183	
Total air circulation or Design air	5.03	l/s.m^2

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional	PI / PID	Total
Control Mode			0%
	Fixed Discharge	Reset	
Control Strategy			0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	23	°C	73.4	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	21	°C	69.8	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning — Changes/Year:

Incidence of Annual Room Controls Maintenance:

Incidence of Annual HVAC Controls Maintenance:

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Retail	> 100,000 ft^2		Lower Mainland
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	525	Lux	48.8	ft-candles
Floor Fraction (GLFF)	0.55			
Connected Load	15.1	W/m^2	1.4	W/ft^2
Occ. Period(Hrs./yr.)	4100			
Unocc. Period(Hrs./yr.)	4660			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	20%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	500	600	700	800	Total
% Distribution	75%	25%	0%	0%	100%
Weighted Average					**525**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			60.0%	0%	40.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft^2.yr	3.7
	MJ/m^2.yr	145

ARCHITECTURAL LIGHTING

Light Level	505	Lux	46.9	ft-candles
Floor Fraction (ALFF)	0.30			
Connected Load	61.0	W/m^2	5.7	W/ft^2
Occ. Period(Hrs./yr.)	4100			
Unocc. Period(Hrs./yr.)	4660			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	30%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	400	500	600	700	Total
% Distribution	25%	50%	20%	5%	100%
Weighted Average					**505**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	75%	25%					0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft^2.yr	9.0
	MJ/m^2.yr	349

SPECIAL PURPOSE LIGHTING

Light Level	500.00	Lux	46.5	ft-candles
Floor Fraction (HBLFF)	0.15			
Connected Load	23.3	W/m^2	2.2	W/ft^2
Occ. Period(Hrs./yr.)	4100			
Unocc. Period(Hrs./yr.)	4660			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	15%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 | 1.00

Light Level (Lux)	400	500	600	700	Total
% Distribution	40%	30%	20%	10%	100%
Weighted Average					**500**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)						100%		100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft^2.yr	1.5
	MJ/m^2.yr	58

TOTAL LIGHTING

Overall LPD	26.64 W/m^2	EUI TOTAL	kWh/ft^2.yr	14.2
	2.48 W/ft^2		MJ/m^2.yr	552

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Servers		Plug Loads	
Measured Power (W/device)	55		51		100		200		217			
Density (device/occupant)	0.648828		0.648828		0.01		0.01		0.03			
Connected Load	0.8	W/m^2	0.7	W/m^2	0.0	W/m^2	0.0	W/m^2	0.5	W/m^2	1.75	W/m^2
	0.1	W/ft^2	0.1	W/ft^2	0.00	W/ft^2	0.00	W/ft^2	0.05	W/ft^2	0.16	W/ft^2
Diversity Occupied Period	90%		90%		90%		90%		100%		90%	
Diversity Unoccupied Period	50%		50%		50%		50%		100%		25%	
Operation Occ. Period (hrs./year)	2000		2000		2600		2600		2600		4100	
Operation Unocc. Period (hrs./year)	6760		6760		6160		6160		6160		4660	

Total end-use load (occupied period)	3.5	W/m^2	0.3	W/ft^2
Total end-use load (unocc. period)	1.7	W/m^2	0.2	W/ft^2
Usage during occupied period	100%			
Usage during unoccupied period	50%			

Computer Equipment	EUI	kWh/ft^2.yr	1.18
		MJ/m^2.yr	45.81
Plug Loads	EUI	kWh/ft^2.yr	0.79
		MJ/m^2.yr	30.59

FOOD SERVICE EQUIPMENT

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft^2.yr	0.3	EUI	kWh/ft^2.yr	0.3
	MJ/m^2.yr	10.0		MJ/m^2.yr	10.0

REFRIGERATION

Provide description below:

Commercial refrigeration display cases

EUI	kWh/ft^2.yr	0.3
	MJ/m^2.yr	10.0

MISCELLANEOUS

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft^2.yr	0.1	EUI	kWh/ft^2.yr	0.0
	MJ/m^2.yr	5.0		MJ/m^2.yr	0.0

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Retail	> 100,000 ft²		Lower Mainland
Baseline			

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	10%	8%	2%	60%	10%	0%	3%	2%	5%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff.) (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	33.6	W/m²	10.7	Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	249	MJ/m².yr	6.4	kWh/ft².yr
Sizing Factor	1.00			
Electric Fuel Share	10.0%	Fossil Fuel Share	90.0%	

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	kWh/ft².yr	4.8
	MJ/m².yr	185
Gas EUI	kWh/ft².yr	8.4
	MJ/m².yr	326
Market Composite EUI	kWh/ft².yr	8.1
	MJ/m².yr	312

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	10.0%	5.0%	0.0%	0.0%	85.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7	°C	44.6	°F
Condenser Water	30	°C	86	°F
Supply Air	14.0	°C	57.2	°F

Peak Cooling Load	90	W/m²	29	Btu/hr.ft²	421	ft²/Ton
Seasonal Cooling Load (Tertiary Load)	155.6	MJ/m².yr	4.0	kWh/ft².yr		

Sizing Factor 1.00 — Operation (occ. period) 3000 hrs/year — Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C) 80.0%

Electric Fuel Share 100.0% — Gas Fuel Share 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	kWh/ft².yr	1.6
	MJ/m².yr	60
Natural Gas EUI	kWh/ft².yr	0.0
	MJ/m².yr	0
Market Composite EUI	kWh/ft².yr	1.6
	MJ/m².yr	60

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	35%				15%
Eff./COP	0.65				0.75

	Fossil	Elec. Res.
Fuel Share	50%	50%
Blended Efficiency	0.68	0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 35.0

Wetting Use Percentage 90%

	All Electric EUI	Fossil Fuel EUI	Market Composite EUI
kWh/ft².yr	1.0	1.3	1.2
MJ/m².yr	38	51	45.0

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **Large Retail** **Baseline**

SIZE: **> 100,000 ft²**

VINTAGE:

REGION: **Lower Mainland**

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	5.0	L/s.m²	0.99	CFM/ft²
System Static Pressure CAV	500	Pa	2.0	wg
System Static Pressure VAV	750	Pa	3.0	wg
Fan Efficiency	60%			
Fan Motor Efficiency	80%			
Sizing Factor	1.00			
Fan Design Load CAV	5.2	W/m²	0.49	W/ft²
Fan Design Load VAV	7.9	W/m²	0.73	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	95%	5%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	50%	50%	100%	0%

Comments:

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.0	L/s.m²	0.00	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.1	L/s.m²	0.02	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.1	W/m²	0.01	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.024	kW/kW	0.08	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	2.11	W/m²	0.20	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.005	L/s.m²	0.007	U.S. gpm/ft²
Pump Head Pressure	0	kPa	0	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.00	W/m²	0.00	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.004	L/s.m²	0.0057	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	50	kPa	17	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.4	W/m²	0.04	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	32.3	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	1.3	kWh/m².yr
Condenser Pump Energy Consumption	0.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.9	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	1.9	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI	kWh/ft².yr	3.4
	MJ/m².yr	130.9

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Large Retail	**> 100,000 ft²**		**Lower Mainland**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**23.5** kWh/ft².yr	**910.3** MJ/m².yr	**Fossil Fue**	**8.6** kWh/ft².yr	**334.5** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr	**END USE:**	Electricity kWh/ft².yr	Electricity MJ/m².yr	Fossil Fuel kWh/ft².yr	Fossil Fuel MJ/m².yr
GENERAL LIGHTING	3.7	144.8					
ARCHITECTURAL LIGHTING	9.0	349.0	SPACE HEATING	0.5	18.5	7.6	293.8
SPECIAL PURPOSE LIGHTING	1.5	57.8	SPACE COOLING	1.2	48.1	0.0	0.0
OTHER PLUG LOADS	0.8	30.6	DOMESTIC HOT WATER	0.5	19.2	0.7	25.7
HVAC FANS & PUMPS	3.4	130.9	FOOD SERVICE EQUIPMENT	0.3	10.0	0.3	10.0
REFRIGERATION	0.3	10.0	MISCELLANEOUS	0.0	0.0	0.1	5.0
COMPUTER EQUIPMENT	1.2	45.8					
ELEVATORS	0.3	11.6					
OUTDOOR LIGHTING	0.9	33.9					

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Retail	**50,000 - 100,000 ft2**		**Lower Mainland**
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.73	W/m².°C	0.13	Btu/hr.ft² . °F	Typical Building Size	7,500 m²	80,700	ft²
Roof U value (W/m².°C)	0.60	W/m².°C	0.11	Btu/hr.ft² . °F	Typical Footprint (m²)	7,500 m²	80,700	ft²
Glazing U value (W/m².°C)	4.82	W/m².°C	0.85	Btu/hr.ft² . °F	Footprint Aspect Ratio (L:W)	5		
					Percent Conditioned Space	100%		
					Percent Conditioned Space Defined as Exterior Zone	29%		
Window/Wall Ratio (WIWAR) (%)	0.10							
Shading Coefficient (SC)	0.75				Typical # Stories	1		
					Floor to Floor Height (m)	5.0 m	16.5	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	100%		0%		0%		0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	25	m²/person	269	ft²/person
Occupancy Schedule Occ. Period	90%			
Occupancy Schedule Unocc. Period	0%			
Fresh Air Requirements or Outside Air	20	L/s.person	42	CFM/person

%OA 17.40%

Fresh Air Control Type *(enter a 1, 2 or 3) 1
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right: 34%
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation 0.5 L/s.m² 0.10 CFM/ft²
50% operation (%)

Sizing Factor	1.5			
Total Air Circulation or Design Air Flow	4.60	L/s.m²	0.91	CFM/ft²
Infiltration Rate	0.42	L/s.m²	0.08	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based	Total
Incidence of Use	0%		100%	100%
Switchover Point		KJ/kg.	18 °C	
		Btu/lbm	64.4 °F	

Summary of Design Parameters		
Peak Design Cooling Load	2,292,867	
Peak Zone Sensible Load	1,047,255	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	48,718	
Total air circulation or Design air	4.60	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	21	°C	69.8	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	21	°C	69.8	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Retail	50,000 - 100,000 ft2		Lower Mainland
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	550	Lux	51.1	ft-candles
Floor Fraction (GLFF)	0.70			
Connected Load	15.7	W/m²	1.5	W/ft²
Occ. Period(Hrs./yr.)	4800			
Unocc. Period(Hrs./yr.)	3960			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	20%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	450	500	700	1000	Total
% Distribution	20%	50%	30%	0%	100%
Weighted Average					**550**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			55.0%		45.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	5.5
	MJ/m².yr	212

ARCHITECTURAL LIGHTING

Light Level	550	Lux	51.1	ft-candles
Floor Fraction (ALFF)	0.27			
Connected Load	60.8	W/m²	5.7	W/ft²
Occ. Period(Hrs./yr.)	4800			
Unocc. Period(Hrs./yr.)	3960			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	30%			
Fixture Cleaning:				
Incidence of Practice	95%			
Interval	20%	years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	450	500	700	1000	Total
% Distribution	20%	50%	30%	0%	100%
Weighted Average					**550**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	65%	35%					0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	8.8
	MJ/m².yr	340

SPECIAL PURPOSE LIGHTING

Light Level	550.00	Lux	51.1	ft-candles
Floor Fraction (HBLFF)	0.03			
Connected Load	25.6	W/m²	2.4	W/ft²
Occ. Period(Hrs./yr.)	4800			
Unocc. Period(Hrs./yr.)	3960			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	20%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 | 1.00

Light Level (Lux)	450	500	700	1000	Total
% Distribution	20%	50%	30%	0%	100%
Weighted Average					**550**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)						100%		100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	0.4
	MJ/m².yr	15

TOTAL LIGHTING

Overall LPD	27.44 W/m²	EUI TOTAL	kWh/ft².yr	14.6
	2.55 W/ft²		MJ/m².yr	567

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Servers		Plug Loads	
Measured Power (W/device)	55		51		100		200		217			
Density (device/occupant)	0.36046		0.36046		0.01		0.01		0.02			
Connected Load	0.8	W/m²	0.7	W/m²	0.0	W/m²	0.1	W/m²	0.5	W/m²	1.15	W/m²
	0.1	W/ft²	0.1	W/ft²	0.00	W/ft²	0.01	W/ft²	0.05	W/ft²	0.11	W/ft²
Diversity Occupied Period	90%		90%		90%		90%		100%		90%	
Diversity Unoccupied Period	50%		50%		50%		50%		100%		25%	
Operation Occ. Period (hrs./year)	2000		2000		2600		2600		2600		4100	
Operation Unocc. Period (hrs./year)	6760		6760		6160		6160		6160		4660	

Total end-use load (occupied period)	3.0	W/m²	0.3	W/ft²
Total end-use load (unocc. period)	1.6	W/m²	0.2	W/ft²
Usage during occupied period	100%			
Usage during unoccupied period	54%			

Computer Equipment	EUI	kWh/ft².yr	1.21
		MJ/m².yr	46.85
Plug Loads	EUI	kWh/ft².yr	0.52
		MJ/m².yr	20.10

FOOD SERVICE EQUIPMENT

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	0.5	EUI	kWh/ft².yr	0.5
	MJ/m².yr	20.0		MJ/m².yr	20.0

REFRIGERATION

Provide description below:

EUI	kWh/ft².yr	0.2
	MJ/m².yr	8.6

MISCELLANEOUS

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	0.3	EUI	kWh/ft².yr	0.0
	MJ/m².yr	10.0		MJ/m².yr	0.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Retail	50,000 - 100,000 ft2		Lower Mainland
Baseline			

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	5%	2%	2%	55%	25%	0%	5%	1%	5%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff. (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	33.0	W/m²	10.5	Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	266	MJ/m².yr	6.9	kWh/ft².yr
Sizing Factor	1.00			
Electric Fuel Share	11.0%	Fossil Fuel Share	89.0%	

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	5.2
MJ/m².yr	200

Gas EUI	
kWh/ft².yr	9.0
MJ/m².yr	347

Market Composite EUI	
kWh/ft².yr	8.5
MJ/m².yr	331

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	10.0%	6.0%	0.0%	4.0%	80.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7	°C	44.6	°F
Condenser Water	30	°C	86	°F
Supply Air	14.0	°C	57.2	°F

Peak Cooling Load	90	W/m²	28	Btu/hr.ft²	422	ft²/Ton
Seasonal Cooling Load (Tertiary Load)	150.5	MJ/m².yr	3.9	kWh/ft².yr		

Sizing Factor 1.00 — Operation (occ. period) 3000 hrs/year — Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C) 80.0%

Electric Fuel Share 100.0% — Gas Fuel Share 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	1.5
MJ/m².yr	58

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	1.5
MJ/m².yr	58

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	35%				10%
Eff./COP	0.65				0.75

	Fossil		Elec. Res.
Fuel Share	45%		55%
Blended Efficiency	0.67		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 35.0

Wetting Use Percentage 90%

All Electric EUI	
kWh/ft².yr	1.0
MJ/m².yr	38

Fossil Fuel EUI	
kWh/ft².yr	1.3
MJ/m².yr	52

Market Composite EUI	
kWh/ft².yr	1.2
MJ/m².yr	44.6

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Medium Retail	**50,000 - 100,000 ft2**		**Lower Mainland**
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	4.6	L/s.m²	0.91	CFM/ft²
System Static Pressure CAV	500	Pa	2.0	wg
System Static Pressure VAV	500	Pa	2.0	wg
Fan Efficiency	60%			
Fan Motor Efficiency	88%			
Sizing Factor	1.00			
Fan Design Load CAV	4.4	W/m²	0.40	W/ft²
Fan Design Load VAV	4.4	W/m²	0.40	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	100%	0%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	50%	50%	50%	50%
Comments:				

EXHAUST FANS

Washroom Exhaust	50	L/s.washroom	106	CFM/washroom
Washroom Exhaust per gross unit are	0.0	L/s.m²	0.00	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.1	L/s.m²	0.02	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.2	W/m²	0.01	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.020	kW/kW	0.07	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	1.79	W/m²	0.17	W/ft²

Condenser Pump

Pump Design Flow	0.000	L/s.KW	0.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.000	L/s.m²	0.000	U.S. gpm/ft²
Pump Head Pressure	45	kPa	15	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.00	W/m²	0.00	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.004	L/s.m²	0.0057	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	0	kPa	0	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.0	W/m²	0.00	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	26.7	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	0.9	kWh/m².yr
Condenser Pump Energy Consumption	0.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.8	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	0.0	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI	kWh/ft².yr	2.6
	MJ/m².yr	102.2

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Medium Retail	**50,000 - 100,000 ft2**		**Lower Mainland**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**23.0** kWh/ft².yr	**892.4** MJ/m².yr	**Fossil Fuel**	**9.4** kWh/ft².yr	**362.3** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	5.5	212.2
ARCHITECTURAL LIGHTING	8.8	339.9
SPECIAL PURPOSE LIGHTING	0.4	14.8
OTHER PLUG LOADS	0.5	20.1
HVAC FANS & PUMPS	2.6	102.2
REFRIGERATION	0.2	8.6
COMPUTER EQUIPMENT	1.2	46.9
ELEVATORS	0.1	3.9
OUTDOOR LIGHTING	0.9	33.9

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.6	22.0	8.0	308.9
SPACE COOLING	1.2	46.8	0.0	0.0
DOMESTIC HOT WATER	0.5	21.2	0.6	23.4
FOOD SERVICE EQUIPMENT	0.5	20.0	0.5	20.0
MISCELLANEOUS	0.0	0.0	0.3	10.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Food Retail			Lower Mainland
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.73	W/m².°C	0.13	Btu/hr.ft² . °F	Typical Building Size	4,000	m²	43,040	ft²
Roof U value (W/m².°C)	0.60	W/m².°C	0.11	Btu/hr.ft² . °F	Typical Footprint (m²)	4,000	m²	43,040	ft²
Glazing U value (W/m².°C)	4.82	W/m².°C	0.85	Btu/hr.ft² . °F	Footprint Aspect Ratio (L:W)	1			
					Percent Conditioned Space	100%			
					Percent Conditioned Space Defined as Exterior Zone	40%			
Window/Wall Ratio (WIWAR) (%)	0.06								
Shading Coefficient (SC)	0.69				Typical # Stories	1			
					Floor to Floor Height (m)	4.6	m	15.0	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	100%		0%		0%		0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	45	m²/person	484	ft²/person
Occupancy Schedule Occ. Period	90%			
Occupancy Schedule Unocc. Period	0%			
Fresh Air Requirements or Outside Air	60	L/s.person	127	CFM/person

%OA 34.63%

Fresh Air Control Type *(enter a 1, 2 or 3) 1
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right: 0%
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation 0.5 L/s.m² 0.10 CFM/ft²
50% operation (%)

Sizing Factor	1.65			
Total Air Circulation or Design Air Flow	3.85	L/s.m²	0.76	CFM/ft²
Infiltration Rate	0.70	L/s.m²	0.14	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	1,491,587	
Peak Zone Sensible Load	425,176	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	19,779	
Total air circulation or Design air	3.85	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	22	°C	71.6	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	21	°C	69.8	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **SIZE:** **VINTAGE:** **REGION:**
Food Retail **Lower Mainland**
Baseline

LIGHTING

GENERAL LIGHTING

Light Level	600	Lux	55.8	ft-candles
Floor Fraction (GLFF)	0.55			
Connected Load	16.7	W/m²	1.6	W/ft²
Occ. Period(Hrs./yr.)	4100			
Unocc. Period(Hrs./yr.)	4660			
Usage During Occupied Period	100%			
Usage During Unoccupied Period	40%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	500	600	700	800			Total
% Distribution	25%	50%	25%	0%			100%
Weighted Average							**600**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			40.0%		60.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI kWh/ft².yr 5.1
MJ/m².yr 197

ARCHITECTURAL LIGHTING

Light Level	640	Lux	59.5	ft-candles
Floor Fraction (ALFF)	0.05			
Connected Load	80.6	W/m²	7.5	W/ft²
Occ. Period(Hrs./yr.)	4100			
Unocc. Period(Hrs./yr.)	4660			
Usage During Occupied Period	100%			
Usage During Unoccupied Period	50%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	300	500	700	1000			Total
% Distribution	0%	30%	70%	0%			100%
Weighted Average							**640**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	80%	20%					0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI kWh/ft².yr 2.4
EUI = Load X Hrs. X SF X GLFF — MJ/m².yr 93

SPECIAL PURPOSE LIGHTING

Light Level	620.00	Lux	57.6	ft-candles
Floor Fraction (HBLFF)	0.40			
Connected Load	28.9	W/m²	2.7	W/ft²
Occ. Period(Hrs./yr.)	4100			
Unocc. Period(Hrs./yr.)	4660			
Usage During Occupied Period	100%			
Usage During Unoccupied Period	50%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 — 1.00

Light Level (Lux)	300	500	700	1000			Total
% Distribution	0%	40%	60%	0%			100%
Weighted Average							**620**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)						100%		100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI kWh/ft².yr 6.9
MJ/m².yr 268

TOTAL LIGHTING — Overall LPD 13.22 W/m², 1.23 W/ft² — EUI TOTAL kWh/ft².yr 14.4; MJ/m².yr 558

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Servers	Plug Loads
Measured Power (W/device)	55	51	100	200	217	
Density (device/occupant)	0.648828	0.648828	0.01	0.01	0.03	
Connected Load	0.8 W/m²	0.7 W/m²	0.0 W/m²	0.0 W/m²	0.5 W/m²	2.85 W/m²
	0.1 W/ft²	0.1 W/ft²	0.00 W/ft²	0.00 W/ft²	0.05 W/ft²	0.26 W/ft²
Diversity Occupied Period	90%	90%	90%	90%	100%	90%
Diversity Unoccupied Period	50%	50%	50%	50%	100%	50%
Operation Occ. Period (hrs./year)	2000	2000	2600	2600	2600	4100
Operation Unocc. Period (hrs./year)	6760	6760	6160	6160	6160	4660

Total end-use load (occupied period)	4.5 W/m²	0.4 W/ft²
Total end-use load (unocc. period)	2.7 W/m²	0.3 W/ft²
Usage during occupied period	100%	
Usage during unoccupied period	61%	

Computer Equipment	EUI	kWh/ft².yr	1.18
		MJ/m².yr	45.81
Plug Loads	EUI	kWh/ft².yr	1.59
		MJ/m².yr	61.77

FOOD SERVICE EQUIPMENT

Provide description below:

	Gas EUI		Electric EUI	
EUI	kWh/ft².yr	2.1	kWh/ft².yr	1.5
	MJ/m².yr	80.0	MJ/m².yr	60.0

REFRIGERATION

Provide description below:

Commercial refrigeration display cases

EUI kWh/ft².yr 31.0
MJ/m².yr 1200.0

MISCELLANEOUS

Provide description below:

	Gas EUI		Electric EUI	
EUI	kWh/ft².yr	0.5	kWh/ft².yr	1.5
	MJ/m².yr	20.0	MJ/m².yr	60.0

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: SIZE: VINTAGE: REGION:
Food Retail **Lower Mainland**
Baseline

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	5%	2%	2%	56%	25%	0%	5%		5%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff.) (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	28.0 W/m²	8.9 Btu/hr.ft²	
Seasonal Heating Load (Tertiary Load)	308 MJ/m².yr	7.9 kWh/ft².yr	
Sizing Factor	1.00		
Electric Fuel Share	10.0%	Fossil Fuel Share	90.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	6.3
MJ/m².yr	244

Gas EUI	
kWh/ft².yr	10.4
MJ/m².yr	401

Market Composite EUI	
kWh/ft².yr	9.9
MJ/m².yr	385

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	0.0%	0.0%	0.0%	10.0%	90.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7 °C	44.6 °F
Condenser Water	30 °C	86 °F
Supply Air	14.0 °C	57.2 °F

Peak Cooling Load	109 W/m²	35 Btu/hr.ft²	346 ft²/Ton
Seasonal Cooling Load (Tertiary Load)	166.8 MJ/m².yr	4.3 kWh/ft².yr	

Sizing Factor 1.00 Operation (occ. period) 3000 hrs/year Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C) 60.0%

Electric Fuel Share 100.0% Gas Fuel Share 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenan

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	1.6
MJ/m².yr	63

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	1.6
MJ/m².yr	63

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	60%				5%
Eff./COP	0.65				0.75

	Fossil		Elec. Res.
Fuel Share	65%		35%
Blended Efficiency	0.66		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 70.0

Wetting Use Percentage 90%

All Electric EUI	
kWh/ft².yr	2.0
MJ/m².yr	77

Fossil Fuel EUI	
kWh/ft².yr	2.7
MJ/m².yr	106

Market Composite EUI	
kWh/ft².yr	2.5
MJ/m².yr	96.1

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **SIZE:** **VINTAGE:** **REGION:**
Food Retail **Lower Mainland**
Baseline

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	3.9	L/s.m²	0.76	CFM/ft²
System Static Pressure CAV	500	Pa	2.0	wg
System Static Pressure VAV	1000	Pa	4.0	wg
Fan Efficiency	60%			
Fan Motor Efficiency	80%			
Sizing Factor	1.00			
Fan Design Load CAV	4.0	W/m²	0.37	W/ft²
Fan Design Load VAV	8.0	W/m²	0.75	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	100%	0%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	60%	40%	100%	0%
Comments:				

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m²	0.01	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.2	L/s.m²	0.03	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.2	W/m²	0.02	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.024	kW/kW	0.08	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	2.57	W/m²	0.24	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.006	L/s.m²	0.009	U.S. gpm/ft²
Pump Head Pressure	0	kPa	0	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.00	W/m²	0.00	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.005	L/s.m²	0.0069	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.9	W/m²	0.09	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	26.7	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	1.8	kWh/m².yr
Condenser Pump Energy Consumption	0.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.9	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	4.7	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI	kWh/ft².yr	3.2
	MJ/m².yr	122.6

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Food Retail			**Lower Mainland**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES: **Electricity:** **58.1** kWh/ft².yr **2,252.5** MJ/m².yr **Fossil Fuel** **13.7** kWh/ft².yr **530.1** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	5.1	197.3
ARCHITECTURAL LIGHTING	2.4	93.3
SPECIAL PURPOSE LIGHTING	6.9	267.6
OTHER PLUG LOADS	1.6	61.8
HVAC FANS & PUMPS	3.2	122.6
REFRIGERATION	31.0	1,200.0
COMPUTER EQUIPMENT	1.2	45.8
ELEVATORS	0.1	3.9
OUTDOOR LIGHTING	1.3	50.9

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.6	24.4	9.3	360.9
SPACE COOLING	1.0	37.9	0.0	0.0
DOMESTIC HOT WATER	0.7	26.9	1.8	69.2
FOOD SERVICE EQUIPMENT	1.5	60.0	2.1	80.0
MISCELLANEOUS	1.5	60.0	0.5	20.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: | **SIZE:** | **VINTAGE:** | **REGION:**
Large Hotel | **Lower Mainland**
Baseline

CONSTRUCTION

Wall U value (W/m².°C)	0.82	W/m².°C	0.14	Btu/hr.ft² . °F	Typical Building Size	20,000	m²	215,200	ft²
Roof U value (W/m².°C)	0.61	W/m².°C	0.11	Btu/hr.ft² . °F	Typical Footprint (m²)	2,000	m²	21,520	ft²
Glazing U value (W/m².°C)	4.30	W/m².°C	0.76	Btu/hr.ft² . °F	Footprint Aspect Ratio (L:W)	3			
					Percent Conditioned Space	100%			
					Percent Conditioned Space Defined as Exterior Zone	45%			
Window/Wall Ratio (WIWAR) (%)	0.30								
Shading Coefficient (SC)	0.65				Typical # Stories	10			
					Floor to Floor Height (m)	3.7	m	12.0	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	80%		0%		20%		0%		100%
Min. Air Flow (%)					60%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	50	m²/person	538	ft²/person
Occupancy Schedule Occ. Period	50%			
Occupancy Schedule Unocc. Period	80%			
Fresh Air Requirements or Outside Air	80	L/s.person	170	CFM/person

%OA 29.24%

Fresh Air Control Type *(enter a 1, 2 or 3) 1
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right: 15%
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation: 0.5 L/s.m² | 0.10 CFM/ft² | 50% operation (%)

Sizing Factor	2.25			
Total Air Circulation or Design Air Flow	5.47	L/s.m²	1.08	CFM/ft²
Infiltration Rate	0.70	L/s.m²	0.14	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	8,542,376	
Peak Zone Sensible Load	2,215,308	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	103,056	
Total air circulation or Design air	5.47	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	23	°C	73.4	°F	15	°C	59	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	20.8	°C	69.44	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning — Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Hotel			Lower Mainland
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	290	Lux	27.0	ft-candles
Floor Fraction (GLFF)	0.25			
Connected Load	8.2	W/m²	0.8	W/ft²
Occ. Period(Hrs./yr.)	3000			
Unocc. Period(Hrs./yr.)	5760			
Usage During Occupied Period	85%			
Usage During Unoccupied Period	90%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	200	300	400	500			Total
% Distribution	50%	20%	20%	10%			100%
Weighted Average							**290**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			50.0%		50.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	1.5
	MJ/m².yr	57

ARCHITECTURAL LIGHTING

Light Level	220	Lux	20.4	ft-candles
Floor Fraction (ALFF)	0.75			
Connected Load	21.0	W/m²	1.9	W/ft²
Occ. Period(Hrs./yr.)	2500			
Unocc. Period(Hrs./yr.)	6260			
Usage During Occupied Period	60%			
Usage During Unoccupied Period	40%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	100	200	300	400			Total
% Distribution	20%	50%	20%	10%			100%
Weighted Average							**220**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	50%	50%					0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	5.8
	MJ/m².yr	227

SPECIAL PURPOSE LIGHTING

Light Level	0.00	Lux	0.0	ft-candles
Floor Fraction (HBLFF)	0.00			
Connected Load	0.0	W/m²	0.0	W/ft²
Occ. Period(Hrs./yr.)	4000			
Unocc. Period(Hrs./yr.)	4760			
Usage During Occupied Period	0%			
Usage During Unoccupied Period	100%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 — 1.00

Light Level (Lux)	300	500	700	1000			Total
% Distribution		0%	0%	0%			0%
Weighted Average							**0**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)								0.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	0.0
	MJ/m².yr	0

TOTAL LIGHTING

Overall LPD	17.77 W/m²	EUI TOTAL	kWh/ft².yr	7.3
	1.65 W/ft²		MJ/m².yr	284

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Servers	Plug Loads
Measured Power (W/device)	55	51	100	200	217	
Density (device/occupant)	0.3	0.3	0.05	0.033	0.03	
Connected Load	0.3 W/m²	0.3 W/m²	0.1 W/m²	0.1 W/m²	0.5 W/m²	2.1 W/m²
	0.0 W/ft²	0.0 W/ft²	0.01 W/ft²	0.01 W/ft²	0.05 W/ft²	0.20 W/ft²
Diversity Occupied Period	90%	90%	90%	90%	100%	70%
Diversity Unoccupied Period	50%	50%	50%	50%	100%	25%
Operation Occ. Period (hrs./year)	2500	2500	2500	2500	2500	3000
Operation Unocc. Period (hrs./year)	6260	6260	6260	6260	6260	5760

Total end-use load (occupied period)	2.8	W/m²	0.3	W/ft²
Total end-use load (unocc. period)	1.5	W/m²	0.1	W/ft²
Usage during occupied period	100%			
Usage during unoccupied period	53%			

Computer Equipment	EUI	kWh/ft².yr	0.85
		MJ/m².yr	32.93
Plug Loads	EUI	kWh/ft².yr	0.69
		MJ/m².yr	26.76

FOOD SERVICE EQUIPMENT

Provide description below:

Kitchen

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	2.6	EUI	kWh/ft².yr	0.5
	MJ/m².yr	100.0		MJ/m².yr	20.0

REFRIGERATION

Provide description below:

Walk-in coolers/freezers, reach-in coolers/freezers, refrigerated buffet cases

EUI	kWh/ft².yr	0.8
	MJ/m².yr	30.0

MISCELLANEOUS

Provide description below:

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	1.5	EUI	kWh/ft².yr	0.0
	MJ/m².yr	60.0		MJ/m².yr	0.0

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Hotel			Lower Mainland
Baseline			

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	42%	20%	5%	18%	0%	0%	5%	2%	8%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff.) (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	31.1 W/m²	9.9 Btu/hr.ft²	
Seasonal Heating Load (Tertiary Load)	266 MJ/m².yr	6.9 kWh/ft².yr	
Sizing Factor	1.00		
Electric Fuel Share	15.0%	Fossil Fuel Share	85.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	kWh/ft².yr	5.3
	MJ/m².yr	206
Gas EUI	kWh/ft².yr	8.9
	MJ/m².yr	346
Market Composite EUI	kWh/ft².yr	8.4
	MJ/m².yr	325

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	45.0%	25.0%	0.0%	0.0%	30.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7 °C	44.6 °F
Condenser Water	30 °C	86 °F
Supply Air	15.0 °C	59 °F

Peak Cooling Load	113 W/m²	36 Btu/hr.ft²	336 ft²/Ton
Seasonal Cooling Load (Tertiary Load)	165.5 MJ/m².yr	4.3 kWh/ft².yr	

Sizing Factor 0.90 — Operation (occ. period) 3000 hrs/year Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C) 80.0%

Electric Fuel Share 100.0% — Gas Fuel Share 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	kWh/ft².yr	1.6
	MJ/m².yr	64
Natural Gas EUI	kWh/ft².yr	0.0
	MJ/m².yr	0
Market Composite EUI	kWh/ft².yr	1.6
	MJ/m².yr	64

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank					Boiler
System Present (%)	20%					70%
Eff./COP	0.65					0.75

	Fossil		Elec. Res.
Fuel Share	90%		10%
Blended Efficiency	0.73		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 236.6

Wetting Use Percentage 90%

All Electric EUI	kWh/ft².yr	6.7
	MJ/m².yr	260
Fossil Fuel EUI	kWh/ft².yr	8.4
	MJ/m².yr	325
Market Composite EUI	kWh/ft².yr	8.2
	MJ/m².yr	318.6

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Hotel			Lower Mainland
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	5.5	L/s.m²	1.08	CFM/ft²
System Static Pressure CAV	500	Pa	2.0	wg
System Static Pressure VAV	750	Pa	3.0	wg
Fan Efficiency	55%			
Fan Motor Efficiency	80%			
Sizing Factor	1.00			
Fan Design Load CAV	6.2	W/m²	0.58	W/ft²
Fan Design Load VAV	9.3	W/m²	0.87	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	80%	20%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	50%	50%	100%	0%
Comments:				

EXHAUST FANS

Washroom Exhaust	550	L/s.washroom	1165	CFM/washroom
Washroom Exhaust per gross unit are	0.6	L/s.m²	0.11	CFM/ft²
Other Exhaust (Smoking/Conference)	0.5	L/s.m²	0.10	CFM/ft²
Total Building Exhaust	1.1	L/s.m²	0.21	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	50%			
Fan Motor Efficiency	80%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.7	W/m²	0.06	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.023	kW/kW	0.08	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	2.57	W/m²	0.24	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.006	L/s.m²	0.009	U.S. gpm/ft²
Pump Head Pressure	100	kPa	33.333333	ft
Pump Efficiency	55%			
Pump Motor Efficiency	85%			
Sizing Factor	1.0			
Pump Connected Load	1.28	W/m²	0.12	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.005	L/s.m²	0.0071	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	85%					
Sizing Factor	0.8					
Pump Connected Load	0.9	W/m²	0.08	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	38.7	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	5.7	kWh/m².yr
Condenser Pump Energy Consumption	2.9	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.9	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	4.6	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI		
	kWh/ft².yr	4.9
	MJ/m².yr	190.3

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Large Hotel			**Lower Mainland**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**18.6** kWh/ft².yr	**720.1** MJ/m².yr	**Fossil Fue**	**19.3** kWh/ft².yr	**746.4** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr	**END USE:**	Electricity kWh/ft².yr	Electricity MJ/m².yr	Fossil Fuel kWh/ft².yr	Fossil Fuel MJ/m².yr
GENERAL LIGHTING	1.5	57.2					
ARCHITECTURAL LIGHTING	5.8	226.5	SPACE HEATING	0.8	30.8	7.6	293.8
SPECIAL PURPOSE LIGHTING	0.0	0.0	SPACE COOLING	1.3	50.9	0.0	0.0
OTHER PLUG LOADS	0.7	26.8	DOMESTIC HOT WATER	0.7	26.0	7.6	292.6
HVAC FANS & PUMPS	4.9	190.3	FOOD SERVICE EQUIPMENT	0.5	20.0	2.6	100.0
REFRIGERATION	0.8	30.0	MISCELLANEOUS	0.0	0.0	1.5	60.0
COMPUTER EQUIPMENT	0.9	32.9					
ELEVATORS	0.3	11.6					
OUTDOOR LIGHTING	0.4	17.0					

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Medium Hotel	**50,000 to 100,000 ft²**		**Lower Mainland**
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.82	W/m².°C	0.14	Btu/hr.ft² . °F	Typical Building Size	6,000 m²	64,560	ft²
Roof U value (W/m².°C)	0.56	W/m².°C	0.10	Btu/hr.ft² . °F	Typical Footprint (m²)	1,500 m²	16,140	ft²
Glazing U value (W/m².°C)	4.30	W/m².°C	0.76	Btu/hr.ft² . °F	Footprint Aspect Ratio (L:W)	4		
					Percent Conditioned Space	100%		
					Percent Conditioned Space Defined as Exterior Zone	45%		
Window/Wall Ratio (WIWAR) (%)	0.28							
Shading Coefficient (SC)	0.57				Typical # Stories	4		
					Floor to Floor Height (m)	3.7 m	12.0	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	90%		0%		10%		0%		100%
Min. Air Flow (%)					60%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	46	m²/person	495	ft²/person	%OA	17.67%
Occupancy Schedule Occ. Period	50%					
Occupancy Schedule Unocc. Period	80%					
Fresh Air Requirements or Outside Air	25	L/s.person	53	CFM/person		

Fresh Air Control Type *(enter a 1, 2 or 3) | 1
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right:	15%			
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation	0.5	L/s.m²	0.10	CFM/ft²
	50%	operation (%)		

Sizing Factor	1.4			
Total Air Circulation or Design Air Flow	3.08	L/s.m²	0.61	CFM/ft²
Infiltration Rate	1.00	L/s.m²	0.20	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based	Total
Incidence of Use	0%		100%	100%
Switchover Point		KJ/kg.	18 °C	
		Btu/lbm	64.4 °F	

Summary of Design Parameters		
Peak Design Cooling Load	1,256,663	
Peak Zone Sensible Load	600,488	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	27,935	
Total air circulation or Design air	3.08	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	22	°C	71.6	°F	13	°C	55.4	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	21	°C	69.8	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning — Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Hotel	50,000 to 100,000 ft²		Lower Mainland
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	125	Lux	11.6	ft-candles
Floor Fraction (GLFF)	0.20			
Connected Load	3.5	W/m²	0.3	W/ft²
Occ. Period(Hrs./yr.)	3400			
Unocc. Period(Hrs./yr.)	5360			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	40%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

					Total
Light Level (Lux)	125	300	700	1000	Total
% Distribution	100%	0%	0%	0%	100%
Weighted Average					**125**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			50.0%		50.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI		
EUI	kWh/ft².yr	0.4
	MJ/m².yr	14

ARCHITECTURAL LIGHTING

Light Level	160	Lux	14.9	ft-candles
Floor Fraction (ALFF)	0.80			
Connected Load	16.9	W/m²	1.6	W/ft²
Occ. Period(Hrs./yr.)	2300			
Unocc. Period(Hrs./yr.)	6460			
Usage During Occupied Period	65%			
Usage During Unoccupied Period	50%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

					Total
Light Level (Lux)	100	125	150	300	Total
% Distribution	20%	40%	20%	20%	100%
Weighted Average					**160**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	60%	40%					0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI		
EUI	kWh/ft².yr	5.9
	MJ/m².yr	230

SPECIAL PURPOSE LIGHTING

Light Level	0.00	Lux	0.0	ft-candles
Floor Fraction (HBLFF)	0.00			
Connected Load	0.0	W/m²	0.0	W/ft²
Occ. Period(Hrs./yr.)	4000			
Unocc. Period(Hrs./yr.)	4760			
Usage During Occupied Period	0%			
Usage During Unoccupied Period	100%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 | 1.00

					Total
Light Level (Lux)	300	500	700	1000	Total
% Distribution		0%	0%	0%	0%
Weighted Average					**0**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)								0.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI		
EUI	kWh/ft².yr	0.0
	MJ/m².yr	0

TOTAL LIGHTING

Overall LPD	14.21 W/m²		EUI TOTAL	kWh/ft².yr	6.3
	1.32 W/ft²			MJ/m².yr	243

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Servers		Plug Loads	
Measured Power (W/device)	55		51		100		200		217			
Density (device/occupant)	0.3		0.3		0.05		0.033		0.02			
Connected Load	0.4	W/m²	0.3	W/m²	0.1	W/m²	0.1	W/m²	0.5	W/m²	2.05	W/m²
	0.0	W/ft²	0.0	W/ft²	0.01	W/ft²	0.01	W/ft²	0.05	W/ft²	0.19	W/ft²
Diversity Occupied Period	90%		90%		90%		90%		100%		70%	
Diversity Unoccupied Period	50%		50%		50%		50%		100%		25%	
Operation Occ. Period (hrs./year)	2500		2500		2500		2500		2500		3000	
Operation Unocc. Period (hrs./year)	6260		6260		6260		6260		6260		5760	

Total end-use load (occupied period)	2.8	W/m²	0.3	W/ft²
Total end-use load (unocc. period)	1.5	W/m²	0.1	W/ft²
Usage during occupied period	100%			
Usage during unoccupied period	54%			

Computer Equipment	EUI	kWh/ft².yr	0.89
		MJ/m².yr	34.38
Plug Loads	EUI	kWh/ft².yr	0.67
		MJ/m².yr	26.13

FOOD SERVICE EQUIPMENT

Provide description below:

Kitchen services

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	1.5	EUI	kWh/ft².yr	0.5
	MJ/m².yr	60.0		MJ/m².yr	20.0

REFRIGERATION

Provide description below:

Walk-in coolers/freezers, reach-in coolers/freezers, refrigerated buffet cases

EUI	kWh/ft².yr	0.8
	MJ/m².yr	30.0

MISCELLANEOUS

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	1.5	EUI	kWh/ft².yr	0.0
	MJ/m².yr	60.0		MJ/m².yr	0.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **Medium Hotel** **Baseline**

SIZE: **50,000 to 100,000 ft²**

VINTAGE:

REGION: **Lower Mainland**

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	15%	10%	5%	30%	0%	0%	2%		38%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff.) (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	43.6 W/m²		13.8 Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	350 MJ/m².yr		9.0 kWh/ft².yr
Sizing Factor	1.00		
Electric Fuel Share	40.0%	Fossil Fuel Share	60.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	8.8
MJ/m².yr	343
Gas EUI	
kWh/ft².yr	11.7
MJ/m².yr	455
Market Composite EUI	
kWh/ft².yr	10.6
MJ/m².yr	410

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	0.0%	0.0%	15.0%	15.0%	70.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7 °C	44.6 °F
Condenser Water	30 °C	86 °F
Supply Air	13.0 °C	55.4 °F

Peak Cooling Load	52 W/m²	17 Btu/hr.ft²	725 ft²/Ton
Seasonal Cooling Load (Tertiary Load)	109.4 MJ/m².yr	2.8 kWh/ft².yr	

Sizing Factor 0.85 — Operation (occ. period) 3000 hrs/year — Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C) 50.0%

Electric Fuel Share 100.0% — Gas Fuel Share 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	1.2
MJ/m².yr	45
Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0
Market Composite EUI	
kWh/ft².yr	1.2
MJ/m².yr	45

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	40%				30%
Eff./COP	0.65				0.75

	Fossil		Elec. Res.
Fuel Share	70%		30%
Blended Efficiency	0.69		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 236.6

Wetting Use Percentage 90%

All Electric EUI		Fossil Fuel EUI		Market Composite EUI	
kWh/ft².yr	6.7	kWh/ft².yr	8.8	kWh/ft².yr	8.2
MJ/m².yr	260	MJ/m².yr	341	MJ/m².yr	317.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **Medium Hotel** **Baseline** | **SIZE:** **50,000 to 100,000 ft²** | **VINTAGE:** | **REGION:** **Lower Mainland**

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	3.1	L/s.m²	0.61	CFM/ft²
System Static Pressure CAV	337.5	Pa	1.4	wg
System Static Pressure VAV	531.25	Pa	2.1	wg
Fan Efficiency	45%			
Fan Motor Efficiency	80%			
Sizing Factor	1.00			
Fan Design Load CAV	2.9	W/m²	0.27	W/ft²
Fan Design Load VAV	4.5	W/m²	0.42	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	90%	10%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	50%	50%	100%	0%
Comments:				

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m²	0.03	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.2	L/s.m²	0.05	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.3	W/m²	0.03	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.027	kW/kW	0.09	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	1.41	W/m²	0.13	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.003	L/s.m²	0.004	U.S. gpm/ft²
Pump Head Pressure	0	kPa	0	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.00	W/m²	0.00	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.002	L/s.m²	0.0033	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.4	W/m²	0.04	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	17.9	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	2.7	kWh/m².yr
Condenser Pump Energy Consumption	0.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.7	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	2.2	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI	kWh/ft².yr	2.2
	MJ/m².yr	85.0

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Hotel	50,000 to 100,000 ft²		Lower Mainland
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**17.8**	kWh/ft².yr	**688.0**	MJ/m².yr	**Fossil Fue**	**16.3**	kWh/ft².yr	**632.1** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr	**END USE:**	Electricity		Fossil Fuel	
				kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	0.4	13.7					
ARCHITECTURAL LIGHTING	5.9	229.7	SPACE HEATING	3.5	137.1	7.0	273.1
SPECIAL PURPOSE LIGHTING	0.0	0.0	SPACE COOLING	0.6	22.3	0.0	0.0
OTHER PLUG LOADS	0.7	26.1	DOMESTIC HOT WATER	2.0	78.0	6.2	239.0
HVAC FANS & PUMPS	2.2	85.0	FOOD SERVICE EQUIPMENT	0.5	20.0	1.5	60.0
REFRIGERATION	0.8	30.0	MISCELLANEOUS	0.0	0.0	1.5	60.0
COMPUTER EQUIPMENT	0.9	34.4					
ELEVATORS	0.3	11.6					
OUTDOOR LIGHTING	0.0	0.0					

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: Hospital Baseline | **SIZE:** | **VINTAGE:** | **REGION:** Lower Mainland

CONSTRUCTION

Wall U value (W/m².°C)	0.67	W/m².°C	0.12	Btu/hr.ft² . °F
Roof U value (W/m².°C)	0.58	W/m².°C	0.10	Btu/hr.ft² . °F
Glazing U value (W/m².°C)	4.30	W/m².°C	0.76	Btu/hr.ft² . °F
Window/Wall Ratio (WIWAR) (%)	0.15			
Shading Coefficient (SC)	0.65			

Typical Building Size	14,000	m²	150,640	ft²
Typical Footprint (m²)	1,750	m²	18,830	ft²
Footprint Aspect Ratio (L:W)	2			
Percent Conditioned Space	100%			
Percent Conditioned Space Defined as Exterior Zone	45%			
Typical # Stories	8			
Floor to Floor Height (m)	4.3	m	14.0	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	50%		0%		50%		0%		100%
Min. Air Flow (%)					60%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	30	m²/person	323	ft²/person
Occupancy Schedule Occ. Period	90%			
Occupancy Schedule Unocc. Period	75%			
Fresh Air Requirements or Outside Air	75	L/s.person	159	CFM/person

%OA 45.11%

Fresh Air Control Type *(enter a 1, 2 or 3) 1
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right: 15%
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation: 0.5 L/s.m² 0.10 CFM/ft²; 50% operation (%)

Sizing Factor	2			
Total Air Circulation or Design Air Flow	5.54	L/s.m²	1.09	CFM/ft²
Infiltration Rate	0.70	L/s.m²	0.14	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based	Total
Incidence of Use	0%		100%	100%
Switchover Point		KJ/kg.	18 °C	
		Btu/lbm	64.4 °F	

Summary of Design Parameters		
Peak Design Cooling Load	8,738,539	
Peak Zone Sensible Load	1,766,990	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	82,200	
Total air circulation or Design air	5.54	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	24	°C	75.2	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	23	°C	73.4	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	23	°C	73.4	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning — Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Hospital			Lower Mainland
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	475	Lux	44.1	ft-candles
Floor Fraction (GLFF)	0.75			
Connected Load	13.1	W/m²	1.2	W/ft²
Occ. Period(Hrs./yr.)	3200			
Unocc. Period(Hrs./yr.)	5560			
Usage During Occupied Period	80%			
Usage During Unoccupied Period	35%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	100	250	700	800			Total
% Distribution		50%	50%	0%			100%
Weighted Average							**475**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			33.0%		67.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	4.1
	MJ/m².yr	159

ARCHITECTURAL LIGHTING

Light Level	340	Lux	31.6	ft-candles
Floor Fraction (ALFF)	0.25			
Connected Load	32.4	W/m²	3.0	W/ft²
Occ. Period(Hrs./yr.)	2500			
Unocc. Period(Hrs./yr.)	6260			
Usage During Occupied Period	80%			
Usage During Unoccupied Period	35%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	100	250	700	800			Total
% Distribution		80%	20%	0%			100%
Weighted Average							**340**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	50%	50%						100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	3.2
	MJ/m².yr	122

SPECIAL PURPOSE LIGHTING

Light Level	0.00	Lux	0.0	ft-candles
Floor Fraction (HBLFF)	0.00			
Connected Load	0.0	W/m²	0.0	W/ft²
Occ. Period(Hrs./yr.)	4000			
Unocc. Period(Hrs./yr.)	4760			
Usage During Occupied Period	0%			
Usage During Unoccupied Period	100%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 | 1.00

Light Level (Lux)	300	500	700	1000			Total
% Distribution		0%	0%	0%			0%
Weighted Average							**0**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)								0.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	0.0
	MJ/m².yr	0

TOTAL LIGHTING

Overall LPD	17.89 W/m²	EUI TOTAL	kWh/ft².yr	7.3
	1.66 W/ft²		MJ/m².yr	281

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Servers	Plug Loads
Measured Power (W/device)	55	51	100	200	217	
Density (device/occupant)	0.477744	0.477744	0.02	0.02	0.04	
Connected Load	0.9 W/m²	0.8 W/m²	0.1 W/m²	0.1 W/m²	0.5 W/m²	3.85 W/m²
	0.1 W/ft²	0.1 W/ft²	0.01 W/ft²	0.01 W/ft²	0.05 W/ft²	0.36 W/ft²
Diversity Occupied Period	90%	90%	90%	90%	100%	90%
Diversity Unoccupied Period	50%	50%	50%	50%	100%	25%
Operation Occ. Period (hrs./year)	2000	2000	2600	2600	2600	4100
Operation Unocc. Period (hrs./year)	6760	6760	6160	6160	6160	4660

Total end-use load (occupied period)	5.7 W/m²	0.5 W/ft²
Total end-use load (unocc. period)	2.4 W/m²	0.2 W/ft²
Usage during occupied period	100%	
Usage during unoccupied period	43%	

Computer Equipment	EUI	kWh/ft².yr	1.33
		MJ/m².yr	51.37
Plug Loads	EUI	kWh/ft².yr	1.74
		MJ/m².yr	67.29

FOOD SERVICE EQUIPMENT

Provide description below:

Commercial food services

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	1.8	EUI	kWh/ft².yr	1.3
	MJ/m².yr	70.0		MJ/m².yr	50.0

REFRIGERATION

Provide description below:

Walk-in coolers/freezers, reach-in coolers/freezers, refrigerated buffet cases

EUI	kWh/ft².yr	0.4
	MJ/m².yr	15.0

MISCELLANEOUS

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	6.5	EUI	kWh/ft².yr	0.0
	MJ/m².yr	250.0		MJ/m².yr	

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Hospital			Lower Mainland
Baseline			

SPACE HEATING

Heating Plant Type

							Electric			Other	
				Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	10%	75%	0%	10%	0%	0%	1%	0%	4%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff.) (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	20.2	W/m²	6.4	Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	711	MJ/m².yr	18.4	kWh/ft².yr
Sizing Factor	1.00			
Electric Fuel Share	5.0%	Fossil Fuel Share	95.0%	

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	16.9
MJ/m².yr	653

Gas EUI	
kWh/ft².yr	23.3
MJ/m².yr	902

Market Composite EUI	
kWh/ft².yr	23.0
MJ/m².yr	889

SPACE COOLING

A/C Plant Type

			WSHP			Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	60.0%	20.0%	0.0%	15.0%	5.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7	°C	44.6	°F
Condenser Water	30	°C	86	°F
Supply Air	14.0	°C	57.2	°F

Peak Cooling Load	183	W/m²	58	Btu/hr.ft²	207	ft²/Ton
Seasonal Cooling Load (Tertiary Load)	195.6	MJ/m².yr	5.0	kWh/ft².yr		

Sizing Factor: 1.00 — Operation (occ. period): 3000 hrs/year — Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C): 85.0%

Electric Fuel Share: 100.0% — Gas Fuel Share: 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	2.6
MJ/m².yr	101

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	2.6
MJ/m².yr	101

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	10%				80%
Eff./COP	0.65				0.80

	Fossil	Elec. Res.
Fuel Share	90%	10%
Blended Efficiency	0.78	0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load): 250.0

Wetting Use Percentage: 90%

All Electric EUI	
kWh/ft².yr	7.1
MJ/m².yr	275

Fossil Fuel EUI	
kWh/ft².yr	8.2
MJ/m².yr	319

Market Composite EUI	
kWh/ft².yr	8.1
MJ/m².yr	314.7

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Hospital			**Lower Mainland**
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	5.5	L/s.m²	1.09	CFM/ft²
System Static Pressure CAV	875	Pa	3.5	wg
System Static Pressure VAV	838	Pa	3.4	wg
Fan Efficiency	52%			
Fan Motor Efficiency	85%			
Sizing Factor	1.00			
Fan Design Load CAV	11.0	W/m²	1.02	W/ft²
Fan Design Load VAV	10.5	W/m²	0.98	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	50%	50%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	80%	20%	100%	0%

Comments:

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m²	0.02	CFM/ft²
Other Exhaust (Smoking/Conference)	0.5	L/s.m²	0.10	CFM/ft²
Total Building Exhaust	0.6	L/s.m²	0.12	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.8	W/m²	0.08	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.020	kW/kW	0.07	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	3.66	W/m²	0.34	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.010	L/s.m²	0.014	U.S. gpm/ft²
Pump Head Pressure	100	kPa	33.333333	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	2.42	W/m²	0.23	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.008	L/s.m²	0.0116	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	1.6	W/m²	0.15	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	71.2	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	7.2	kWh/m².yr
Condenser Pump Energy Consumption	6.4	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	1.0	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	7.9	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI		
	kWh/ft².yr	8.7
	MJ/m².yr	337.4

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Hospital			Lower Mainland
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:				
Electricity:	25.7 kWh/ft².yr	993.7 MJ/m².yr		
Fossil Fue	37.8 kWh/ft².yr	1,463.9 MJ/m².yr		

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	4.1	158.9
ARCHITECTURAL LIGHTING	3.2	122.1
SPECIAL PURPOSE LIGHTING	0.0	0.0
OTHER PLUG LOADS	1.7	67.3
HVAC FANS & PUMPS	8.7	337.4
REFRIGERATION	0.4	15.0
COMPUTER EQUIPMENT	1.3	51.4
ELEVATORS	0.3	11.6
OUTDOOR LIGHTING	0.9	33.9

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.8	32.6	22.1	856.7
SPACE COOLING	2.2	86.0	0.0	0.0
DOMESTIC HOT WATER	0.7	27.5	7.4	287.2
FOOD SERVICE EQUIPMENT	1.3	50.0	1.8	70.0
MISCELLANEOUS	0.0	0.0	6.5	250.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Nursing Home	**50,000 to 100,000 ft²**		**Lower Mainland**
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.67	W/m².°C	0.12	Btu/hr.ft² . °F
Roof U value (W/m².°C)	0.56	W/m².°C	0.10	Btu/hr.ft² . °F
Glazing U value (W/m².°C)	4.57	W/m².°C	0.80	Btu/hr.ft² . °F
Window/Wall Ratio (WIWAR) (%)	0.28			
Shading Coefficient (SC)	0.60			

Typical Building Size	5,600	m²	60,256	ft²
Typical Footprint (m²)	2,800	m²	30,128	ft²
Footprint Aspect Ratio (L:W)	7			
Percent Conditioned Space	100%			
Percent Conditioned Space Defined as Exterior Zone	45%			
Typical # Stories	2			
Floor to Floor Height (m)	3.7	m	12.0	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	90%		0%		10%	0%	0%		100%
Min. Air Flow (%)					60%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	30	m²/person	323	ft²/person
Occupancy Schedule Occ. Period	100%			
Occupancy Schedule Unocc. Period	95%			
Fresh Air Requirements or Outside Air	38	L/s.person	81	CFM/person

%OA 36.98%

Fresh Air Control Type *(enter a 1, 2 or 3) 1
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right: 15%
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation 0.5 L/s.m² 0.10 CFM/ft²
50% operation (%)

Sizing Factor	1.3			
Total Air Circulation or Design Air Flow	3.42	L/s.m²	0.67	CFM/ft²
Infiltration Rate	0.30	L/s.m²	0.06	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	2,110,762	
Peak Zone Sensible Load	671,967	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	31,260	
Total air circulation or Design air	3.42	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	23	°C	73.4	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	23	°C	73.4	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	23	°C	73.4	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Nursing Home	**50,000 to 100,000 ft²**		**Lower Mainland**
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	267	Lux	24.8	ft-candles
Floor Fraction (GLFF)	0.70			
Connected Load	7.3	W/m²	0.7	W/ft²

Occ. Period(Hrs./yr.)	3400	
Unocc. Period(Hrs./yr.)	5360	
Usage During Occupied Period	95%	
Usage During Unoccupied Period	20%	
Fixture Cleaning:		
Incidence of Practice		
Interval		years
Relamping Strategy & Incidence of Practice	Group	Spot

Light Level (Lux)	200	300	500	1000				Total
% Distribution	33%	67%	0%	0%				100%
Weighted Average								**267**
	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			33.0%		67.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	2.1
	MJ/m².yr	80

ARCHITECTURAL LIGHTING

Light Level	233	Lux	21.7	ft-candles
Floor Fraction (ALFF)	0.30			
Connected Load	24.6	W/m²	2.3	W/ft²

Occ. Period(Hrs./yr.)	3400	
Unocc. Period(Hrs./yr.)	5360	
Usage During Occupied Period	95%	
Usage During Unoccupied Period	30%	
Fixture Cleaning:		
Incidence of Practice		
Interval		years
Relamping Strategy & Incidence of Practice	Group	Spot

Light Level (Lux)	200	300	400	500				Total
% Distribution	67%	33%	0%	0%				100%
Weighted Average								**233**
	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	60%	40%					0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	3.3
	MJ/m².yr	128

SPECIAL PURPOSE LIGHTING

Light Level	0.00	Lux	0.0	ft-candles
Floor Fraction (HBLFF)	0.00			
Connected Load	0.0	W/m²	0.0	W/ft²

Floor fraction check: should = 1.00 | 1.00

Occ. Period(Hrs./yr.)	4000	
Unocc. Period(Hrs./yr.)	4760	
Usage During Occupied Period	0%	
Usage During Unoccupied Period	100%	
Fixture Cleaning:		
Incidence of Practice		
Interval		years
Relamping Strategy & Incidence of Practice	Group	Spot

Light Level (Lux)	300	500	700	1000				Total
% Distribution		0%	0%	0%				0%
Weighted Average								**0**
	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)								0.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	0.0
	MJ/m².yr	0

TOTAL LIGHTING

Overall LPD	12.51 W/m²	EUI TOTAL	kWh/ft².yr	5.4
	1.16 W/ft²		MJ/m².yr	208

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Servers	Plug Loads
Measured Power (W/device)	55	51	100	200	217	
Density (device/occupant)	0.477744	0.477744	0.02	0.02	0.04	
Connected Load	0.9 W/m²	0.8 W/m²	0.1 W/m²	0.1 W/m²	0.5 W/m²	1.35 W/m²
	0.1 W/ft²	0.1 W/ft²	0.01 W/ft²	0.01 W/ft²	0.05 W/ft²	0.13 W/ft²
Diversity Occupied Period	90%	90%	90%	90%	100%	90%
Diversity Unoccupied Period	50%	50%	50%	50%	100%	25%
Operation Occ. Period (hrs./year)	2000	2000	2600	2600	2600	4100
Operation Unocc. Period (hrs./year)	6760	6760	6160	6160	6160	4660

Total end-use load (occupied period)	3.4 W/m²	0.3 W/ft²
Total end-use load (unocc. period)	1.8 W/m²	0.2 W/ft²
Usage during occupied period	100%	
Usage during unoccupied period	52%	

Computer Equipment	EUI	kWh/ft².yr	1.33
		MJ/m².yr	51.37
Plug Loads	EUI	kWh/ft².yr	0.61
		MJ/m².yr	23.60

FOOD SERVICE EQUIPMENT

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	1.5	EUI	kWh/ft².yr	1.3
	MJ/m².yr	60.0		MJ/m².yr	50.0

REFRIGERATION

Provide description below:

Walk-in coolers/freezers, reach-in coolers/freezers, refrigerated buffet cases

EUI	kWh/ft².yr	0.8
	MJ/m².yr	30.0

MISCELLANEOUS

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	1.8	EUI	kWh/ft².yr	0.0
	MJ/m².yr	70.0		MJ/m².yr	

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **Nursing Home** **Baseline**
SIZE: **50,000 to 100,000 ft²**
VINTAGE:
REGION: **Lower Mainland**

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	35%	35%	5%	10%	5%	0%	5%	0%	5%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff.) (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load: 32.4 W/m² — 10.3 Btu/hr.ft²
Seasonal Heating Load (Tertiary Load): 328 MJ/m².yr — 8.5 kWh/ft².yr
Sizing Factor: 1.00

Electric Fuel Share: 10.0% — Fossil Fuel Share: 90.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	6.7
MJ/m².yr	260

Gas EUI	
kWh/ft².yr	10.9
MJ/m².yr	421

Market Composite EUI	
kWh/ft².yr	10.4
MJ/m².yr	405

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	0.0%	0.0%	0.0%	15.0%	85.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

	°C	°F
Chilled Water	7	44.6
Condenser Water	30	86
Supply Air	14.0	57.2

Peak Cooling Load: 94 W/m² — 30 Btu/hr.ft² — 403 ft²/Ton
Seasonal Cooling Load (Tertiary Load): 129.1 MJ/m².yr — 3.3 kWh/ft².yr

Sizing Factor: 0.85 — Operation (occ. period): 3000 hrs/year — Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C): 30.0%

Electric Fuel Share: 100.0% — Gas Fuel Share: 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenan

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	1.5
MJ/m².yr	56

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	1.5
MJ/m².yr	56

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	10%				60%
Eff./COP	0.65				0.75

	Fossil		Elec. Res.
Fuel Share	70%		30%
Blended Efficiency	0.74		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load): 175.0

Wetting Use Percentage: 90%

All Electric EUI	
kWh/ft².yr	5.0
MJ/m².yr	192

Fossil Fuel EUI	
kWh/ft².yr	6.1
MJ/m².yr	238

Market Composite EUI	
kWh/ft².yr	5.8
MJ/m².yr	224.2

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **Nursing Home** **Baseline**
SIZE: **50,000 to 100,000 ft²**
VINTAGE:
REGION: **Lower Mainland**

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	3.4	L/s.m²	0.67	CFM/ft²
System Static Pressure CAV	500	Pa	2.0	wg
System Static Pressure VAV	500	Pa	2.0	wg
Fan Efficiency	52%			
Fan Motor Efficiency	75%			
Sizing Factor	1.00			
Fan Design Load CAV	4.4	W/m²	0.41	W/ft²
Fan Design Load VAV	4.4	W/m²	0.41	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	90%	10%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	80%	20%	100%	0%
Comments:				

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m²	0.01	CFM/ft²
Other Exhaust (Smoking/Conference)	0.5	L/s.m²	0.10	CFM/ft²
Total Building Exhaust	0.6	L/s.m²	0.11	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.8	W/m²	0.07	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.020	kW/kW	0.07	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	1.88	W/m²	0.17	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.005	L/s.m²	0.007	U.S. gpm/ft²
Pump Head Pressure	0	kPa	0	ft
Pump Efficiency	55%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.00	W/m²	0.00	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.004	L/s.m²	0.0060	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	55%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.7	W/m²	0.07	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	32.9	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	6.7	kWh/m².yr
Condenser Pump Energy Consumption	0.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.7	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	3.7	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI		
	kWh/ft².yr	4.1
	MJ/m².yr	158.1

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Nursing Home	50,000 to 100,000 ft²		Lower Mainland
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**17.2**	kWh/ft².yr	**667.3**	MJ/m².yr	**Fossil Fue**	**17.4** kWh/ft².yr	**675.1** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr	END USE:	Electricity		Fossil Fuel	
				kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	2.1	79.6					
ARCHITECTURAL LIGHTING	3.3	128.4	SPACE HEATING	0.7	26.0	9.8	378.6
SPECIAL PURPOSE LIGHTING	0.0	0.0	SPACE COOLING	0.4	16.9	0.0	0.0
OTHER PLUG LOADS	0.6	23.6	DOMESTIC HOT WATER	1.5	57.7	4.3	166.5
HVAC FANS & PUMPS	4.1	158.1	FOOD SERVICE EQUIPMENT	1.3	50.0	1.5	60.0
REFRIGERATION	0.8	30.0	MISCELLANEOUS	0.0	0.0	1.8	70.0
COMPUTER EQUIPMENT	1.3	51.4					
ELEVATORS	0.3	11.6					
OUTDOOR LIGHTING	0.9	33.9					

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Schools	> 50,000 ft2		Lower Mainland
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.64	W/m².°C	0.11	Btu/hr.ft² . °F	
Roof U value (W/m².°C)	0.61	W/m².°C	0.11	Btu/hr.ft² . °F	
Glazing U value (W/m².°C)	4.57	W/m².°C	0.80	Btu/hr.ft² . °F	
Window/Wall Ratio (WIWAR) (%)	0.13				
Shading Coefficient (SC)	0.65				

Typical Building Size	9,300	m²	100,068	ft²
Typical Footprint (m²)	4,650	m²	50,034	ft²
Footprint Aspect Ratio (L:W)	5			
Percent Conditioned Space	100%			
Percent Conditioned Space Defined as Exterior Zone	37%			
Typical # Stories	2			
Floor to Floor Height (m)	4.0	m	13.2	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	90%		0%		10%		0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	10	m²/person	108	ft²/person
Occupancy Schedule Occ. Period	90%			
Occupancy Schedule Unocc. Period	0%			
Fresh Air Requirements or Outside Air	9	L/s.person	19	CFM/person

%OA 28.92%

Fresh Air Control Type *(enter a 1, 2 or 3) | 1 | If Fresh Air Control Type = "2" enter % FA. to the right: | 34%

(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air) | If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation | 0.5 L/s.m² | 0.10 CFM/ft²

50% operation (%)

Sizing Factor	1.5			
Total Air Circulation or Design Air Flow	3.11	L/s.m²	0.61	CFM/ft²
Infiltration Rate	0.42	L/s.m²	0.08	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	2,733,944	
Peak Zone Sensible Load	878,925	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	40,888	
Total air circulation or Design air	3.11	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	23	°C	73.4	°F	13	°C	55.4	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	20.4	°C	68.72	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning — Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Schools	> 50,000 ft2		Lower Mainland
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	440	Lux	40.9	ft-candles
Floor Fraction (GLFF)	0.89			
Connected Load	12.1	W/m²	1.1	W/ft²

Occ. Period(Hrs./yr.)	3000	
Unocc. Period(Hrs./yr.)	5760	
Usage During Occupied Period	85%	
Usage During Unoccupied Period	25%	
Fixture Cleaning:		
Incidence of Practice		
Interval		years

Light Level (Lux)	300	500	700	1000			Total
% Distribution	40%	50%	10%	0%			100%
Weighted Average							**440**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			35.0%		65.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

Relamping Strategy & Incidence of Practice	Group	Spot

EUI	kWh/ft².yr	4.0
	MJ/m².yr	155

ARCHITECTURAL LIGHTING

Light Level	400	Lux	37.2	ft-candles
Floor Fraction (ALFF)	0.01			
Connected Load	27.8	W/m²	2.6	W/ft²

Occ. Period(Hrs./yr.)	3000	
Unocc. Period(Hrs./yr.)	5760	
Usage During Occupied Period	90%	
Usage During Unoccupied Period	75%	
Fixture Cleaning:		
Incidence of Practice		
Interval		years

Light Level (Lux)	300	500	700	1000			Total
% Distribution	50%	50%	0%	0%			100%
Weighted Average							**400**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	25%	75%						100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

Relamping Strategy & Incidence of Practice	Group	Spot

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	0.2
	MJ/m².yr	7

SPECIAL PURPOSE LIGHTING

Light Level	300.00	Lux	27.9	ft-candles
Floor Fraction (HBLFF)	0.10			
Connected Load	14.0	W/m²	1.3	W/ft²

Floor fraction check: should = 1.00 | 1.00

Occ. Period(Hrs./yr.)	3000	
Unocc. Period(Hrs./yr.)	5760	
Usage During Occupied Period	100%	
Usage During Unoccupied Period	25%	
Fixture Cleaning:		
Incidence of Practice		
Interval		years

Light Level (Lux)	300	500	700	1000			Total
% Distribution	100%	0%	0%	0%			100%
Weighted Average							**300**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)						100%		100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

Relamping Strategy & Incidence of Practice	Group	Spot

EUI	kWh/ft².yr	0.6
	MJ/m².yr	22

TOTAL LIGHTING

Overall LPD	12.48 W/m²	EUI TOTAL	kWh/ft².yr	4.8
	1.16 W/ft²		MJ/m².yr	185

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Servers		Plug Loads	
Measured Power (W/device)	55		51		100		200		217			
Density (device/occupant)	0.222732		0.222732		0.02		0.02		0.01			
Connected Load	1.2	W/m²	1.1	W/m²	0.2	W/m²	0.4	W/m²	0.5	W/m²	0.25	W/m²
	0.1	W/ft²	0.1	W/ft²	0.02	W/ft²	0.04	W/ft²	0.05	W/ft²	0.02	W/ft²
Diversity Occupied Period	90%		90%		90%		90%		100%		100%	
Diversity Unoccupied Period	25%		25%		25%		25%		100%		0%	
Operation Occ. Period (hrs./year)	2000		2000		2000		2000		2600		3000	
Operation Unocc. Period (hrs./year)	6760		6760		6760		6760		6160		5760	

Total end-use load (occupied period)	3.4	W/m²	0.3	W/ft²
Total end-use load (unocc. period)	1.3	W/m²	0.1	W/ft²
Usage during occupied period	100%			
Usage during unoccupied period	37%			

Computer Equipment	EUI	kWh/ft².yr	1.37
		MJ/m².yr	53.21
Plug Loads	EUI	kWh/ft².yr	0.07
		MJ/m².yr	2.70

FOOD SERVICE EQUIPMENT

Provide description below:

Cafeteria

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	0.5	EUI	kWh/ft².yr	0.1
	MJ/m².yr	20.0		MJ/m².yr	5.0

REFRIGERATION

Provide description below:

EUI	kWh/ft².yr	0.1
	MJ/m².yr	2.1

MISCELLANEOUS

Provide description below:

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	0.1	EUI	kWh/ft².yr	0.0
	MJ/m².yr	5.0		MJ/m².yr	0.0

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Schools	> 50,000 ft2		Lower Mainland
Baseline			

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	45%	20%	7%	10%	12%	0%	3%	0%	3%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff. (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	26.3 W/m²	8.3 Btu/hr.ft²	
Seasonal Heating Load (Tertiary Load)	230 MJ/m².yr	5.9 kWh/ft².yr	
Sizing Factor	1.00		
Electric Fuel Share	6.0%	Fossil Fuel Share	94.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	4.7
MJ/m².yr	183

Gas EUI	
kWh/ft².yr	7.7
MJ/m².yr	297

Market Composite EUI	
kWh/ft².yr	7.5
MJ/m².yr	290

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	0.0%	0.0%	0.0%	15.0%	85.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7 °C	44.6 °F
Condenser Water	30 °C	86 °F
Supply Air	13.0 °C	55.4 °F

Peak Cooling Load	86 W/m²	27 Btu/hr.ft²	439 ft²/Ton
Seasonal Cooling Load (Tertiary Load)	107.0 MJ/m².yr	2.8 kWh/ft².yr	

Sizing Factor 1.00 Operation (occ. period) 3000 hrs/year Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C) 10.0%

Electric Fuel Share 100.0% Gas Fuel Share 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	1.1
MJ/m².yr	44

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	1.1
MJ/m².yr	44

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank					Boiler
System Present (%)	45%					25%
Eff./COP	0.65					0.75

	Fossil		Elec. Res.
Fuel Share	70%		30%
Blended Efficiency	0.69		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 40.0

Wetting Use Percentage 90%

All Electric EUI	
kWh/ft².yr	1.1
MJ/m².yr	44

Fossil Fuel EUI	
kWh/ft².yr	1.5
MJ/m².yr	58

Market Composite EUI	
kWh/ft².yr	1.4
MJ/m².yr	54.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Large Schools	**> 50,000 ft2**		**Lower Mainland**
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	3.1	L/s.m²	0.61	CFM/ft²
System Static Pressure CAV	500	Pa	2.0	wg
System Static Pressure VAV	500	Pa	2.0	wg
Fan Efficiency	60%			
Fan Motor Efficiency	88%			
Sizing Factor	1.00			
Fan Design Load CAV	2.9	W/m²	0.27	W/ft²
Fan Design Load VAV	2.9	W/m²	0.27	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	90%	10%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	40%	60%	50%	50%

Comments:

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.0	L/s.m²	0.01	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.1	L/s.m²	0.03	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.2	W/m²	0.02	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.020	kW/kW	0.07	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	1.72	W/m²	0.16	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.005	L/s.m²	0.007	U.S. gpm/ft²
Pump Head Pressure	0	kPa	0	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.00	W/m²	0.00	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.004	L/s.m²	0.0055	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.7	W/m²	0.07	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	15.9	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	1.2	kWh/m².yr
Condenser Pump Energy Consumption	0.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.5	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	3.7	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI		
	kWh/ft².yr	2.0
	MJ/m².yr	76.8

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Large Schools	**> 50,000 ft2**		**Lower Mainland**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**9.7** kWh/ft².yr	**373.8** MJ/m².yr	**Fossil Fue**	**8.9** kWh/ft².yr	**344.8** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	4.0	155.2
ARCHITECTURAL LIGHTING	0.2	7.0
SPECIAL PURPOSE LIGHTING	0.6	22.4
OTHER PLUG LOADS	0.1	2.7
HVAC FANS & PUMPS	2.0	76.8
REFRIGERATION	0.1	2.1
COMPUTER EQUIPMENT	1.4	53.2
ELEVATORS	0.1	3.9
OUTDOOR LIGHTING	0.4	17.0

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.3	11.0	7.2	279.0
SPACE COOLING	0.1	4.4	0.0	0.0
DOMESTIC HOT WATER	0.3	13.2	1.1	40.8
FOOD SERVICE EQUIPMENT	0.1	5.0	0.5	20.0
MISCELLANEOUS	0.0	0.0	0.1	5.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Schools	< 50,000 ft2		Lower Mainland
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.64	W/m².°C	0.11	Btu/hr.ft² . °F
Roof U value (W/m².°C)	0.61	W/m².°C	0.11	Btu/hr.ft² . °F
Glazing U value (W/m².°C)	4.57	W/m².°C	0.80	Btu/hr.ft² . °F
Window/Wall Ratio (WIWAR) (%)	0.13			
Shading Coefficient (SC)	0.65			

Typical Building Size	2,300	m²	24,748	ft²
Typical Footprint (m²)	2,300	m²	24,748	ft²
Footprint Aspect Ratio (L:W)	5			
Percent Conditioned Space	100%			
Percent Conditioned Space Defined as Exterior Zone	50%			
Typical # Stories	1			
Floor to Floor Height (m)	4.0	m	13.2	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	100%		0%		0%		0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	10	m²/person	108	ft²/person
Occupancy Schedule Occ. Period	90%			
Occupancy Schedule Unocc. Period	0%			
Fresh Air Requirements or Outside Air	8	L/s.person	16	CFM/person

%OA 25.53%

Fresh Air Control Type *(enter a 1, 2 or 3) 1
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right: 34%
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation 0.5 L/s.m² 0.10 CFM/ft² 50% operation (%)

Sizing Factor	1.3			
Total Air Circulation or Design Air Flow	2.94	L/s.m²	0.58	CFM/ft²
Infiltration Rate	0.42	L/s.m²	0.08	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	627,786	
Peak Zone Sensible Load	236,682	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	11,010	
Total air circulation or Design air	2.94	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	21	°C	69.8	°F	13	°C	55.4	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	20.4	°C	68.72	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning — Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Schools	< 50,000 ft2		Lower Mainland
Baseline			

LIGHTING
GENERAL LIGHTING

Light Level	400	Lux	37.2	ft-candles
Floor Fraction (GLFF)	0.89			
Connected Load	11.0	W/m²	1.0	W/ft²
Occ. Period(Hrs./yr.)	2400			
Unocc. Period(Hrs./yr.)	6360			
Usage During Occupied Period	85%			
Usage During Unoccupied Period	25%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	300	500	700	1000				Total
% Distribution	50%	50%	0%	0%				100%
Weighted Average								**400**
	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			35.0%		65.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI		
EUI	kWh/ft².yr	3.3
	MJ/m².yr	128

ARCHITECTURAL LIGHTING

Light Level	400	Lux	37.2	ft-candles
Floor Fraction (ALFF)	0.01			
Connected Load	27.8	W/m²	2.6	W/ft²
Occ. Period(Hrs./yr.)	2400			
Unocc. Period(Hrs./yr.)	6360			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	30%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	300	500	700	1000				Total
% Distribution	50%	50%	0%	0%				100%
Weighted Average								**400**
	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	25%	75%						100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI		
EUI	kWh/ft².yr	0.1
	MJ/m².yr	4

SPECIAL PURPOSE LIGHTING

Light Level	300.00	Lux	27.9	ft-candles
Floor Fraction (HBLFF)	0.10			
Connected Load	14.0	W/m²	1.3	W/ft²
Occ. Period(Hrs./yr.)	4000			
Unocc. Period(Hrs./yr.)	4760			
Usage During Occupied Period	100%			
Usage During Unoccupied Period	10%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 | 1.00

Light Level (Lux)	300	500	700	1000				Total
% Distribution	100%	0%	0%	0%				100%
Weighted Average								**300**
	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)						100%		100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI		
EUI	kWh/ft².yr	0.6
	MJ/m².yr	23

TOTAL LIGHTING

Overall LPD	10.10 W/m²	EUI TOTAL	kWh/ft².yr	4.0
	0.94 W/ft²		MJ/m².yr	155

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Servers	Plug Loads
Measured Power (W/device)	55	51	100	200	217	
Density (device/occupant)	0.05	0.05	0.02	0.02	0.01	
Connected Load	0.3 W/m²	0.3 W/m²	0.2 W/m²	0.4 W/m²	0.5 W/m²	0.2 W/m²
	0.0 W/ft²	0.0 W/ft²	0.02 W/ft²	0.04 W/ft²	0.05 W/ft²	0.02 W/ft²
Diversity Occupied Period	90%	90%	90%	90%	100%	100%
Diversity Unoccupied Period	25%	25%	25%	25%	100%	0%
Operation Occ. Period (hrs./year)	2900	2900	2600	2600	2600	3000
Operation Unocc. Period (hrs./year)	5860	5860	6160	6160	6160	5760

Total end-use load (occupied period)	1.7 W/m²	0.2 W/ft²
Total end-use load (unocc. period)	0.8 W/m²	0.1 W/ft²
Usage during occupied period	100%	
Usage during unoccupied period	46%	

Computer Equipment	EUI	kWh/ft².yr	0.83
		MJ/m².yr	32.30
Plug Loads	EUI	kWh/ft².yr	0.06
		MJ/m².yr	2.16

FOOD SERVICE EQUIPMENT
Provide description below:

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	0.3	EUI	kWh/ft².yr	0.2
	MJ/m².yr	10.0		MJ/m².yr	8.0

REFRIGERATION
Provide description below:

EUI	kWh/ft².yr	0.0
	MJ/m².yr	1.1

MISCELLANEOUS
Provide description below:

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	0.1	EUI	kWh/ft².yr	1.2
	MJ/m².yr	5.0		MJ/m².yr	45.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **Medium Schools** **Baseline**
SIZE: **< 50,000 ft2**
VINTAGE:
REGION: **Lower Mainland**

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	45%	20%	7%	10%	12%	0%	3%	0%	3%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff.) (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	35.8 W/m²		11.4 Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	300 MJ/m².yr		7.7 kWh/ft².yr
Sizing Factor	1.00		
Electric Fuel Share	6.0%	Fossil Fuel Share	94.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	6.1
MJ/m².yr	238

Gas EUI	
kWh/ft².yr	10.0
MJ/m².yr	386

Market Composite EUI	
kWh/ft².yr	9.7
MJ/m².yr	377

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7 °C	44.6 °F
Condenser Water	30 °C	86 °F
Supply Air	13.0 °C	55.4 °F

Peak Cooling Load	80 W/m²	25 Btu/hr.ft²	473 ft²/Ton
Seasonal Cooling Load (Tertiary Load)	96.6 MJ/m².yr	2.5 kWh/ft².yr	

Sizing Factor: 1.00 — Operation (occ. period) 3000 hrs/year — Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C): 10.0%

Electric Fuel Share: 100.0% — Gas Fuel Share: 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	1.1
MJ/m².yr	41

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	1.1
MJ/m².yr	41

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	45%				25%
Eff./COP	0.65				0.75

	Fossil	Elec. Res.
Fuel Share	70%	30%
Blended Efficiency	0.69	0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load): 40.0

Wetting Use Percentage: 90%

All Electric EUI	
kWh/ft².yr	1.1
MJ/m².yr	44

Fossil Fuel EUI	
kWh/ft².yr	1.5
MJ/m².yr	58

Market Composite EUI	
kWh/ft².yr	1.4
MJ/m².yr	54.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Medium Schools	**< 50,000 ft2**		**Lower Mainland**
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	2.9	L/s.m²	0.58	CFM/ft²
System Static Pressure CAV	250	Pa	1.0	wg
System Static Pressure VAV	250	Pa	1.0	wg
Fan Efficiency	60%			
Fan Motor Efficiency	88%			
Sizing Factor	1.00			
Fan Design Load CAV	1.4	W/m²	0.13	W/ft²
Fan Design Load VAV	1.4	W/m²	0.13	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	65%	35%	50%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	65%	35%	50%	50%
Comments:				

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m²	0.02	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.2	L/s.m²	0.04	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.2	W/m²	0.02	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.020	kW/kW	0.07	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	1.60	W/m²	0.15	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.004	L/s.m²	0.006	U.S. gpm/ft²
Pump Head Pressure	0	kPa	0	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.00	W/m²	0.00	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.003	L/s.m²	0.0051	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.7	W/m²	0.06	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	8.4	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	1.5	kWh/m².yr
Condenser Pump Energy Consumption	0.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.5	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	3.4	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI	kWh/ft².yr	1.3
	MJ/m².yr	50.1

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Medium Schools	**< 50,000 ft2**		**Lower Mainland**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**8.9** kWh/ft².yr	**344.2** MJ/m².yr	**Fossil Fue**	**10.8** kWh/ft².yr	**419.0** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	3.3	128.4
ARCHITECTURAL LIGHTING	0.1	4.2
SPECIAL PURPOSE LIGHTING	0.6	22.5
OTHER PLUG LOADS	0.1	2.2
HVAC FANS & PUMPS	1.3	50.1
REFRIGERATION	0.0	1.1
COMPUTER EQUIPMENT	0.8	32.3
ELEVATORS	0.1	1.9
OUTDOOR LIGHTING	0.4	17.0

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.4	14.3	9.4	363.1
SPACE COOLING	0.1	4.1	0.0	0.0
DOMESTIC HOT WATER	0.3	13.2	1.1	40.8
FOOD SERVICE EQUIPMENT	0.2	8.0	0.3	10.0
MISCELLANEOUS	1.2	45.0	0.1	5.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
University-Colleges			Lower Mainland
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.75	W/m².°C	0.13	Btu/hr.ft² . °F	Typical Building Size	9,000	m²	96,840	ft²
Roof U value (W/m².°C)	0.61	W/m².°C	0.11	Btu/hr.ft² . °F	Typical Footprint (m²)	3,000	m²	32,280	ft²
Glazing U value (W/m².°C)	4.56	W/m².°C	0.80	Btu/hr.ft² . °F	Footprint Aspect Ratio (L:W)	7			
					Percent Conditioned Space	100%			
					Percent Conditioned Space	50%			
Window/Wall Ratio (WIWAR) (%)	0.30				Defined as Exterior Zone				
Shading Coefficient (SC)	0.65				Typical # Stories	3			
					Floor to Floor Height (m)	3.7	m	12.0	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	70%		0%		30%		0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	14	m²/person	151	ft²/person	%OA	20.96%
Occupancy Schedule Occ. Period	90%					
Occupancy Schedule Unocc. Period	0%					
Fresh Air Requirements or Outside Air	15	L/s.person	32	CFM/person		

Fresh Air Control Type *(enter a 1, 2 or 3): 1
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right:	34%			
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation	0.5	L/s.m²	0.10	CFM/ft²
	50%	operation (%)		

Sizing Factor	1.6			
Total Air Circulation or Design Air Flow	5.11	L/s.m²	1.01	CFM/ft²
Infiltration Rate	0.70	L/s.m²	0.14	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based	Total
Incidence of Use	0%		100%	100%
Switchover Point		KJ/kg.	18	°C
		Btu/lbm	64.4	°F

Summary of Design Parameters		
Peak Design Cooling Load	3,348,143	
Peak Zone Sensible Load	1,309,381	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	60,912	
Total air circulation or Design air	5.11	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	24	°C	75.2	°F	13	°C	55.4	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	16	°C	60.8	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	20.4	°C	68.72	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning — Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
University-Colleges			**Lower Mainland**
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	610	Lux	56.7	ft-candles
Floor Fraction (GLFF)	0.93			
Connected Load	16.8	W/m²	1.6	W/ft²

Occ. Period(Hrs./yr.)	4100
Unocc. Period(Hrs./yr.)	4660
Usage During Occupied Period	90%
Usage During Unoccupied Period	20%
Fixture Cleaning:	
Incidence of Practice	
Interval	years
Relamping Strategy & Incidence of Practice	Group / Spot

Light Level (Lux)	300	500	700	1000			Total
% Distribution	10%	25%	65%	0%			100%
Weighted Average							**610**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			35.0%	0%	65.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	6.7
	MJ/m².yr	260

ARCHITECTURAL LIGHTING

Light Level	300	Lux	27.9	ft-candles
Floor Fraction (ALFF)	0.03			
Connected Load	28.6	W/m²	2.7	W/ft²

Occ. Period(Hrs./yr.)	4100
Unocc. Period(Hrs./yr.)	4660
Usage During Occupied Period	100%
Usage During Unoccupied Period	50%
Fixture Cleaning:	
Incidence of Practice	
Interval	years
Relamping Strategy & Incidence of Practice	Group / Spot

Light Level (Lux)	300	500	700	1000			Total
% Distribution	100%	0%	0%	0%			100%
Weighted Average							**300**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	50%	50%					0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	0.5
	MJ/m².yr	20

SPECIAL PURPOSE LIGHTING

Light Level	640.00	Lux	59.5	ft-candles
Floor Fraction (HBLFF)	0.04			
Connected Load	29.8	W/m²	2.8	W/ft²

Floor fraction check: should = 1.00 | 1.00

Occ. Period(Hrs./yr.)	4100
Unocc. Period(Hrs./yr.)	4660
Usage During Occupied Period	90%
Usage During Unoccupied Period	20%
Fixture Cleaning:	
Incidence of Practice	
Interval	years
Relamping Strategy & Incidence of Practice	Group / Spot

Light Level (Lux)	300	500	700	1000			Total
% Distribution	0%	30%	70%	0%			100%
Weighted Average							**640**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)						100%		100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	0.5
	MJ/m².yr	20

TOTAL LIGHTING

Overall LPD	16.51 W/m²	EUI TOTAL	kWh/ft².yr	7.7
	1.53 W/ft²		MJ/m².yr	300

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Servers		Plug Loads	
Measured Power (W/device)	55		51		100		200		217			
Density (device/occupant)	0.311825		0.311825		0.02		0.02		0.01			
Connected Load	1.2	W/m²	1.1	W/m²	0.1	W/m²	0.3	W/m²	0.5	W/m²	1.3	W/m²
	0.1	W/ft²	0.1	W/ft²	0.01	W/ft²	0.03	W/ft²	0.05	W/ft²	0.12	W/ft²
Diversity Occupied Period	90%		90%		90%		90%		100%		100%	
Diversity Unoccupied Period	50%		50%		50%		50%		100%		20%	
Operation Occ. Period (hrs./year)	2000		2000		2600		2600		2600		2000	
Operation Unocc. Period (hrs./year)	6760		6760		6160		6160		6160		6760	

Total end-use load (occupied period)	4.3	W/m²	0.4	W/ft²
Total end-use load (unocc. period)	2.2	W/m²	0.2	W/ft²

Usage during occupied period	100%
Usage during unoccupied period	50%

Computer Equipment	EUI	kWh/ft².yr	1.76
		MJ/m².yr	68.30
Plug Loads	EUI	kWh/ft².yr	0.40
		MJ/m².yr	15.69

FOOD SERVICE EQUIPMENT

Provide description below:

	Gas EUI			Electric EUI		
	EUI	kWh/ft².yr	1.0	EUI	kWh/ft².yr	0.3
		MJ/m².yr	40.0		MJ/m².yr	10.0

REFRIGERATION

Provide description below:

EUI	kWh/ft².yr	0.5
	MJ/m².yr	20.0

MISCELLANEOUS

Provide description below:

	Gas EUI			Electric EUI		
	EUI	kWh/ft².yr	1.8	EUI	kWh/ft².yr	0.0
		MJ/m².yr	70.0		MJ/m².yr	0.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: University-Colleges Baseline | **SIZE:** | **VINTAGE:** | **REGION:** Lower Mainland

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	20%	60%	5%	10%	0%	0%	2%	0%	3%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff.) (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load: 38.0 W/m² — 12.1 Btu/hr.ft²
Seasonal Heating Load (Tertiary Load): 291 MJ/m².yr — 7.5 kWh/ft².yr
Sizing Factor: 1.00

Electric Fuel Share: 5.0% — Fossil Fuel Share: 95.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	6.3
MJ/m².yr	243

Gas EUI	
kWh/ft².yr	9.5
MJ/m².yr	369

Market Composite EUI	
kWh/ft².yr	9.4
MJ/m².yr	363

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	20.0%	5.0%	0.0%	0.0%	75.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7 °C	44.6 °F
Condenser Water	30 °C	86 °F
Supply Air	13.0 °C	55.4 °F

Peak Cooling Load: 109 W/m² — 35 Btu/hr.ft² — 347 ft²/Ton
Seasonal Cooling Load (Tertiary Load): 169.5 MJ/m².yr — 4.4 kWh/ft².yr

Sizing Factor: 1.00 — Operation (occ. period): 3000 hrs/year Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C): 10.0%

Electric Fuel Share: 100.0% — Gas Fuel Share: 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	1.9
MJ/m².yr	72

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	1.9
MJ/m².yr	72

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	10%				75%
Eff./COP	0.65				0.75

	Fossil		Elec. Res.
Fuel Share	85%		15%
Blended Efficiency	0.74		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load): 65.0

Wetting Use Percentage: 90%

All Electric EUI	
kWh/ft².yr	1.8
MJ/m².yr	71

Fossil Fuel EUI	
kWh/ft².yr	2.3
MJ/m².yr	88

Market Composite EUI	
kWh/ft².yr	2.2
MJ/m².yr	85.6

EXISTING BUILDINGS: University-Colleges Baseline | **SIZE:** | **VINTAGE:** | **REGION:** Lower Mainland

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	5.1	L/s.m²	1.01	CFM/ft²
System Static Pressure CAV	1000	Pa	4.0	wg
System Static Pressure VAV	1000	Pa	4.0	wg
Fan Efficiency	60%			
Fan Motor Efficiency	80%			
Sizing Factor	1.00			
Fan Design Load CAV	10.6	W/m²	0.99	W/ft²
Fan Design Load VAV	10.6	W/m²	0.99	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	70%	30%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	50%	50%	100%	0%
Comments:				

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m²	0.01	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.2	L/s.m²	0.03	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.2	W/m²	0.02	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.027	kW/kW	0.09	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	2.94	W/m²	0.27	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.006	L/s.m²	0.009	U.S. gpm/ft²
Pump Head Pressure	0	kPa	0	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.00	W/m²	0.00	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.005	L/s.m²	0.0069	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.9	W/m²	0.09	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	58.4	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	1.9	kWh/m².yr
Condenser Pump Energy Consumption	0.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	1.2	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	4.7	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI		
	kWh/ft².yr	6.2
	MJ/m².yr	238.4

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
University-Colleges			Lower Mainland
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**18.4**	kWh/ft².yr	**711.2**	MJ/m².yr	**Fossil Fuel**	**13.8** kWh/ft².yr	**535.8** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr	**END USE:**	Electricity kWh/ft².yr	Electricity MJ/m².yr	Fossil Fuel kWh/ft².yr	Fossil Fuel MJ/m².yr
GENERAL LIGHTING	6.7	260.5					
ARCHITECTURAL LIGHTING	0.5	19.8	SPACE HEATING	0.3	12.2	9.1	351.0
SPECIAL PURPOSE LIGHTING	0.5	19.9	SPACE COOLING	0.2	7.2	0.0	0.0
OTHER PLUG LOADS	0.4	15.7	DOMESTIC HOT WATER	0.3	10.7	1.9	74.8
HVAC FANS & PUMPS	6.2	238.4	FOOD SERVICE EQUIPMENT	0.3	10.0	1.0	40.0
REFRIGERATION	0.5	20.0	MISCELLANEOUS	0.0	0.0	1.8	70.0
COMPUTER EQUIPMENT	1.8	68.3					
ELEVATORS	0.3	11.6					
OUTDOOR LIGHTING	0.4	17.0					

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **SIZE:** **VINTAGE:** **REGION:**
Restaurant **Lower Mainland**
Baseline

CONSTRUCTION

Wall U value (W/m².°C)	0.59	W/m².°C	0.10	Btu/hr.ft² . °F
Roof U value (W/m².°C)	0.53	W/m².°C	0.09	Btu/hr.ft² . °F
Glazing U value (W/m².°C)	4.43	W/m².°C	0.78	Btu/hr.ft² . °F
Window/Wall Ratio (WIWAR) (%)	0.18			
Shading Coefficient (SC)	0.69			

Typical Building Size	1,225	m²	13,181	ft²
Typical Footprint (m²)	1,225	m²	13,181	ft²
Footprint Aspect Ratio (L:W)	1			
Percent Conditioned Space	100%			
Percent Conditioned Space Defined as Exterior Zone	40%			
Typical # Stories	1			
Floor to Floor Height (m)	4.6	m	15.0	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	100%		0%		0%		0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	20	m²/person	215	ft²/person
Occupancy Schedule Occ. Period	90%			
Occupancy Schedule Unocc. Period	0%			
Fresh Air Requirements or Outside Air	33	L/s.person	70	CFM/person

%OA 32.14%

Fresh Air Control Type *(enter a 1, 2 or 3) 1
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right: 0%
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation 0.5 L/s.m² 0.10 CFM/ft²
50% operation (%)

Sizing Factor	1.4			
Total Air Circulation or Design Air Flow	5.13	L/s.m²	1.01	CFM/ft²
Infiltration Rate	0.70	L/s.m²	0.14	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	615,094	
Peak Zone Sensible Load	204,615	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	9,519	
Total air circulation or Design air	5.13	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	22	°C	71.6	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	21	°C	69.8	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Restaurant			Lower Mainland
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	400	Lux	37.1	ft-candles
Floor Fraction (GLFF)	0.20			
Connected Load	11.7	W/m²	1.1	W/ft²
Occ. Period(Hrs./yr.)	3400			
Unocc. Period(Hrs./yr.)	5360			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	20%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	300	400	500	1000				Total
% Distribution	33%	33%	33%	0%				100%
Weighted Average								**399.6**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			66.0%	0%	34.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	0.9
	MJ/m².yr	36

ARCHITECTURAL LIGHTING

Light Level	250	Lux	23.2	ft-candles
Floor Fraction (ALFF)	0.80			
Connected Load	32.8	W/m²	3.0	W/ft²
Occ. Period(Hrs./yr.)	3400			
Unocc. Period(Hrs./yr.)	5360			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	30%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	100	200	300	400				Total
% Distribution	10%	40%	40%	10%				100%
Weighted Average								**250**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	85%	15%					0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	11.8
	MJ/m².yr	457

SPECIAL PURPOSE LIGHTING

Light Level	0.00	Lux	0.0	ft-candles
Floor Fraction (HBLFF)	0.00			
Connected Load	0.0	W/m²	0.0	W/ft²
Occ. Period(Hrs./yr.)	4000			
Unocc. Period(Hrs./yr.)	4760			
Usage During Occupied Period	0%			
Usage During Unoccupied Period	100%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 | 1.00

Light Level (Lux)	300	500	700	1000				Total
% Distribution		0%	0%	0%				0%
Weighted Average								**0**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)								0.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	0.0
	MJ/m².yr	0

TOTAL LIGHTING

Overall LPD	28.56 W/m²	EUI TOTAL	kWh/ft².yr	12.7
	2.65 W/ft²		MJ/m².yr	493

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Servers		Plug Loads	
Measured Power (W/device)	55		51		100		200		217			
Density (device/occupant)	0.1614		0.1614		0.01		0.01		0.01			
Connected Load	0.4	W/m²	0.4	W/m²	0.1	W/m²	0.1	W/m²	0.5	W/m²	3.2	W/m²
	0.0	W/ft²	0.0	W/ft²	0.00	W/ft²	0.01	W/ft²	0.05	W/ft²	0.30	W/ft²
Diversity Occupied Period	90%		90%		90%		90%		100%		90%	
Diversity Unoccupied Period	50%		50%		50%		50%		100%		90%	
Operation Occ. Period (hrs./year)	2000		2000		2600		2600		2600		4100	
Operation Unocc. Period (hrs./year)	6760		6760		6160		6160		6160		4660	

Total end-use load (occupied period)	4.3	W/m²	0.4	W/ft²
Total end-use load (unocc. period)	3.9	W/m²	0.4	W/ft²
Usage during occupied period	100%			
Usage during unoccupied period	91%			

Computer Equipment	EUI	kWh/ft².yr	0.90
		MJ/m².yr	34.97
Plug Loads	EUI	kWh/ft².yr	2.34
		MJ/m².yr	90.82

FOOD SERVICE EQUIPMENT

Provide description below:

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	23.2	EUI	kWh/ft².yr	8.5
	MJ/m².yr	900.0		MJ/m².yr	330.0

REFRIGERATION

Provide description below:

EUI	kWh/ft².yr	16.8
	MJ/m².yr	650.0

MISCELLANEOUS

Provide description below:

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	0.5	EUI	kWh/ft².yr	0.0
	MJ/m².yr	20.0		MJ/m².yr	0.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: Restaurant Baseline | **SIZE:** | **VINTAGE:** | **REGION:** Lower Mainland

SPACE HEATING

Heating Plant Type

	Stan.	High	Cond.	Forced Air RTU	Forced Air Furnace	Unit Heater	Electric A/A HP	Electric W. S. HP	Electric Resistance	Other District Heat	Total
System Present (%)	2%	1%	1%	48%	35%	0%	1%	2%	10%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff.) (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load: 36.1 W/m² — 11.5 Btu/hr.ft²
Seasonal Heating Load (Tertiary Load): 439 MJ/m².yr — 11.3 kWh/ft².yr
Sizing Factor: 1.00

Electric Fuel Share: 13.0% — Fossil Fuel Share: 87.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

	All Electric EUI	Gas EUI	Market Composite EUI
kWh/ft².yr	9.8	14.7	14.1
MJ/m².yr	380	569	545

SPACE COOLING

A/C Plant Type

	Standard	HE	WSHP			Absorption Chillers W. H.	Absorption Chillers CW	Total
System Present (%)	0.0%	0.0%	0.0%	10.0%	90.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

	°C	°F
Chilled Water	7	44.6
Condenser Water	30	86
Supply Air	14.0	57.2

Peak Cooling Load: 177 W/m² — 56 Btu/hr.ft² — 214 ft²/Ton
Seasonal Cooling Load (Tertiary Load): 216.7 MJ/m².yr — 5.6 kWh/ft².yr

Sizing Factor: 1.20 — Operation (occ. period): 3000 hrs/year — Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C): 70.0%

Electric Fuel Share: 100.0% — Gas Fuel Share: 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

	All Electric EUI	Natural Gas EUI	Market Composite EUI
kWh/ft².yr	2.5	0.0	2.5
MJ/m².yr	96	0	96

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	30%				30%
Eff./COP	0.65				0.75

	Fossil		Elec. Res.
Fuel Share	60%		40%
Blended Efficiency	0.70		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load): 600.0

Wetting Use Percentage: 10%

	All Electric EUI	Fossil Fuel EUI	Market Composite EUI
kWh/ft².yr	17.0	22.1	20.1
MJ/m².yr	659	857	778.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: Restaurant Baseline | **SIZE:** | **VINTAGE:** | **REGION:** Lower Mainland

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	5.1	L/s.m²	1.01	CFM/ft²
System Static Pressure CAV	500	Pa	2.0	wg
System Static Pressure VAV	500	Pa	2.0	wg
Fan Efficiency	60%			
Fan Motor Efficiency	80%			
Sizing Factor	1.00			
Fan Design Load CAV	5.3	W/m²	0.50	W/ft²
Fan Design Load VAV	5.3	W/m²	0.50	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	100%	0%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	80%	20%	100%	0%

Comments:

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.2	L/s.m²	0.03	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.3	L/s.m²	0.05	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.4	W/m²	0.03	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.020	kW/kW	0.07	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	3.53	W/m²	0.33	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.009	L/s.m²	0.014	U.S. gpm/ft²
Pump Head Pressure	0	kPa	0	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.00	W/m²	0.00	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.008	L/s.m²	0.0112	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	0	kPa	0	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.0	W/m²	0.00	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	41.2	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	3.1	kWh/m².yr
Condenser Pump Energy Consumption	0.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	1.2	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	0.0	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI		
	kWh/ft².yr	4.2
	MJ/m².yr	163.6

A 74

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Restaurant			**Lower Mainland**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**59.1** kWh/ft².yr	**2,290.5** MJ/m².yr	**Fossil Fue**	**49.8** kWh/ft².yr	**1,929.4** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr	**END USE:**	Electricity kWh/ft².yr	Electricity MJ/m².yr	Fossil Fuel kWh/ft².yr	Fossil Fuel MJ/m².yr
GENERAL LIGHTING	0.9	36.1					
ARCHITECTURAL LIGHTING	11.8	456.8	SPACE HEATING	1.3	49.4	12.8	495.1
SPECIAL PURPOSE LIGHTING	0.0	0.0	SPACE COOLING	1.7	67.2	0.0	0.0
OTHER PLUG LOADS	2.3	90.8	DOMESTIC HOT WATER	6.8	263.7	13.3	514.3
HVAC FANS & PUMPS	4.2	163.6	FOOD SERVICE EQUIPMENT	8.5	330.0	23.2	900.0
REFRIGERATION	16.8	650.0	MISCELLANEOUS	0.0	0.0	0.5	20.0
COMPUTER EQUIPMENT	0.9	35.0					
ELEVATORS	0.1	1.9					
OUTDOOR LIGHTING	3.8	145.9					

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Warehouse/Whsale	**0**		**Lower Mainland**
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.65	W/m².°C	0.11	Btu/hr.ft² . °F	Typical Building Size	3,200 m²	34,432	ft²
Roof U value (W/m².°C)	0.54	W/m².°C	0.09	Btu/hr.ft² . °F	Typical Footprint (m²)	3,200 m²	34,432	ft²
Glazing U value (W/m².°C)	4.10	W/m².°C	0.72	Btu/hr.ft² . °F	Footprint Aspect Ratio (L:W)	1		
					Percent Conditioned Space	100%		
					Percent Conditioned Space Defined as Exterior Zone	40%		
Window/Wall Ratio (WIWAR) (%)	0.05							
Shading Coefficient (SC)	0.80				Typical # Stories	1		
					Floor to Floor Height (m)	6.1 m	19.9	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	100%		0%		0%		0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	100 m²/person	1076 ft²/person	%OA	16.12%
Occupancy Schedule Occ. Period	90%			
Occupancy Schedule Unocc. Period	0%			
Fresh Air Requirements or Outside Air	35 L/s.person	74 CFM/person		

Fresh Air Control Type *(enter a 1, 2 or 3) | 1 | If Fresh Air Control Type = "2" enter % FA. to the right: 0%
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air) | If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation | 0.5 L/s.m² | 0.10 CFM/ft²
50% operation (%)

Sizing Factor	1.6	
Total Air Circulation or Design Air Flow	2.17 L/s.m²	0.43 CFM/ft²
Infiltration Rate	0.70 L/s.m²	0.14 CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0 L/s.m²	0.00 CFM/ft²
Operation occupied period	50%	
Operation unoccupied period	50%	

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	424,817	
Peak Zone Sensible Load	197,810	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	9,202	
Total air circulation or Design air	2.17	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	22	°C	71.6	°F	13	°C	55.4	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	16	°C	60.8	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	20.25	°C	68.45	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Warehouse/Whsale	0		Lower Mainland
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	500	Lux	46.5	ft-candles
Floor Fraction (GLFF)	0.33			
Connected Load	14.6	W/m²	1.4	W/ft²
Occ. Period(Hrs./yr.)	3500			
Unocc. Period(Hrs./yr.)	5260			
Usage During Occupied Period	100%			
Usage During Unoccupied Period	25%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	300	500	700	1000				Total
% Distribution	0%	100%	0%	0%				100%
Weighted Average								**500**
	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			65.0%	0%	35.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	2.1
	MJ/m².yr	83

ARCHITECTURAL LIGHTING

Light Level	500	Lux	46.5	ft-candles
Floor Fraction (ALFF)	0.02			
Connected Load	55.3	W/m²	5.1	W/ft²
Occ. Period(Hrs./yr.)	2500			
Unocc. Period(Hrs./yr.)	6260			
Usage During Occupied Period	100%			
Usage During Unoccupied Period	50%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	300	500	700	1000				Total
% Distribution	0%	100%	0%	0%				100%
Weighted Average								**500**
	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	65%	35%					0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	0.6
	MJ/m².yr	22

SPECIAL PURPOSE LIGHTING

Light Level	420.00	Lux	39.0	ft-candles
Floor Fraction (HBLFF)	0.65			
Connected Load	16.3	W/m²	1.5	W/ft²
Occ. Period(Hrs./yr.)	3500			
Unocc. Period(Hrs./yr.)	5260			
Usage During Occupied Period	100%			
Usage During Unoccupied Period	25%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 — 1.00

Light Level (Lux)	300	500	700	1000				Total
% Distribution	40%	60%	0%	0%				100%
Weighted Average								**420**
	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)						80%	20%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.7	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	4.7
	MJ/m².yr	183

TOTAL LIGHTING

Overall LPD	16.47 W/m²	EUI TOTAL	kWh/ft².yr	7.5
	1.53 W/ft²		MJ/m².yr	289

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Servers		Plug Loads	
Measured Power (W/device)	55		51		100		200		217			
Density (device/occupant)	0.5918		0.5918		0.03		0.03		0.06			
Connected Load	0.3	W/m²	0.3	W/m²	0.0	W/m²	0.1	W/m²	0.5	W/m²	2.5	W/m²
	0.0	W/ft²	0.0	W/ft²	0.00	W/ft²	0.01	W/ft²	0.05	W/ft²	0.23	W/ft²
Diversity Occupied Period	90%		90%		90%		90%		100%		90%	
Diversity Unoccupied Period	50%		50%		50%		50%		100%		25%	
Operation Occ. Period (hrs./year)	2000		2000		2600		2600		2600		4100	
Operation Unocc. Period (hrs./year)	6760		6760		6160		6160		6160		4660	

Total end-use load (occupied period)	3.4	W/m²	0.3	W/ft²
Total end-use load (unocc. period)	1.5	W/m²	0.1	W/ft²
Usage during occupied period	100%			
Usage during unoccupied period	44%			

Computer Equipment	EUI	kWh/ft².yr	0.76
		MJ/m².yr	29.58
Plug Loads	EUI	kWh/ft².yr	1.13
		MJ/m².yr	43.70

FOOD SERVICE EQUIPMENT

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	0.1	EUI	kWh/ft².yr	0.1
	MJ/m².yr	5.0		MJ/m².yr	4.0

REFRIGERATION

Provide description below:

Walk-in coolers

EUI	kWh/ft².yr	0.6
	MJ/m².yr	25.0

MISCELLANEOUS

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	0.5	EUI	kWh/ft².yr	0.0
	MJ/m².yr	20.0		MJ/m².yr	0.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: Warehouse/Whsale Baseline
SIZE: 0
VINTAGE:
REGION: Lower Mainland

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	Total
	Boilers			Forced Air						Gas	
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Radiant	
System Present (%)	4%	3%	1%	35%	5%	27%		2%	10%	13%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	75%	1.70	3.00	100%	75%	
Performance (1 / Eff.) (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.33	0.59	0.33	1.00	1.33	

Peak Heating Load: 25.0 W/m² — 7.9 Btu/hr.ft²
Seasonal Heating Load (Tertiary Load): 192 MJ/m².yr — 4.9 kWh/ft².yr
Sizing Factor: 1.00

Electric Fuel Share: 12.0% — Fossil Fuel Share: 88.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	4.4
MJ/m².yr	170

Gas EUI	
kWh/ft².yr	6.5
MJ/m².yr	253

Market Composite EUI	
kWh/ft².yr	6.3
MJ/m².yr	244

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	0.0%	0.0%	0.0%	2.0%	98.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

	°C	°F
Chilled Water	7	44.6
Condenser Water	30	86
Supply Air	13.0	55.4

Peak Cooling Load: 39 W/m² — 12 Btu/hr.ft² — 973 ft²/Ton
Seasonal Cooling Load (Tertiary Load): 81.9 MJ/m².yr — 2.1 kWh/ft².yr

Sizing Factor: 1.00 — Operation (occ. period): 3000 hrs/year — Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C): 30.0%

Electric Fuel Share: 100.0% — Gas Fuel Share: 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	0.8
MJ/m².yr	33

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	0.8
MJ/m².yr	33

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	47%				3%
Eff./COP	0.65				0.75

	Fossil	Elec. Res.
Fuel Share	50%	50%
Blended Efficiency	0.66	0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load): 25.0

Wetting Use Percentage: 90%

All Electric EUI	
kWh/ft².yr	0.7
MJ/m².yr	27

Fossil Fuel EUI	
kWh/ft².yr	1.0
MJ/m².yr	38

Market Composite EUI	
kWh/ft².yr	0.8
MJ/m².yr	32.8

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Warehouse/Whsale	0		Lower Mainland
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	2.2	L/s.m²	0.43	CFM/ft²
System Static Pressure CAV	425	Pa	1.7	wg
System Static Pressure VAV	425	Pa	1.7	wg
Fan Efficiency	60%			
Fan Motor Efficiency	80%			
Sizing Factor	1.00			
Fan Design Load CAV	1.9	W/m²	0.18	W/ft²
Fan Design Load VAV	1.9	W/m²	0.18	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	100%	0%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	80%	20%	100%	0%
Comments:				

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m²	0.01	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.2	L/s.m²	0.03	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.2	W/m²	0.02	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.020	kW/kW	0.07	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	0.78	W/m²	0.07	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.002	L/s.m²	0.003	U.S. gpm/ft²
Pump Head Pressure	0	kPa	0	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.00	W/m²	0.00	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.002	L/s.m²	0.0025	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	50	kPa	17	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.2	W/m²	0.02	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	14.8	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	1.9	kWh/m².yr
Condenser Pump Energy Consumption	0.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.4	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	0.7	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI	kWh/ft².yr	1.7
	MJ/m².yr	64.3

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Warehouse/Whsale	**0**		**Lower Mainland**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**13.4** kWh/ft².yr	**520.2** MJ/m².yr	**Fossil Fuel**	**6.9** kWh/ft².yr	**267.0** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	2.1	83.2
ARCHITECTURAL LIGHTING	0.6	22.4
SPECIAL PURPOSE LIGHTING	4.7	183.1
OTHER PLUG LOADS	1.1	43.7
HVAC FANS & PUMPS	1.7	64.3
REFRIGERATION	0.6	25.0
COMPUTER EQUIPMENT	0.8	29.6
ELEVATORS	0.1	3.9
OUTDOOR LIGHTING	0.4	17.0

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.5	20.4	5.8	222.9
SPACE COOLING	0.3	9.8	0.0	0.0
DOMESTIC HOT WATER	0.4	13.7	0.5	19.1
FOOD SERVICE EQUIPMENT	0.1	4.0	0.1	5.0
MISCELLANEOUS	0.0	0.0	0.5	20.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **Large High Rise** **Baseline**

SIZE: **> 9,300 m² (100,000 ft²)**

VINTAGE:

REGION: **Lower Mainland**

CONSTRUCTION

Wall U value (W/m². °C)	0.81	W/m². °C	0.14	Btu/hr.ft² . °F	
Roof U value (W/m². °C)	0.56	W/m². °C	0.10	Btu/hr.ft² . °F	
Glazing U value (W/m². °C)	4.26	W/m². °C	0.75	Btu/hr.ft² . °F	
Window/Wall Ratio (WIWAR) (%)	0.25				
Shading Coefficient (SC)	0.65				

Typical Building Size	21,365	m²	229,887	ft²
Typical Footprint (m²)	1,125	m²	12,100	ft²
Footprint Aspect Ratio (L:W)	2			
Percent Conditioned Space	100%			
Percent Conditioned Space Defined as Exterior Zone	45%			
Typical # Stories	19			
Floor to Floor Height (m)	3.7	m	12.0	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	100%		0%		0%		0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	40	m²/person	430	ft²/person
Occupancy Schedule Occ. Period	25%			
Occupancy Schedule Unocc. Period	80%			
Fresh Air Requirements or Outside Air	10	L/s.person	21	CFM/person

%OA 100.00%

Fresh Air Control Type *(enter a 1, 2 or 3) 3
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right: 0%
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation 0.25 L/s.m² 0.05 CFM/ft²
75% operation (%)

Sizing Factor	1			
Total Air Circulation or Design Air Flow	0.25	L/s.m²	0.05	CFM/ft²
Infiltration Rate (air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)	0.05	L/s.m²	0.01	CFM/ft²

Separate Make-up air unit (100% OA)		L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	2,820,151	
Peak Zone Sensible Load	1,738,474	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	80,874	
Total air circulation or Design air	1.79	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	20	°C	68	°F	13	°C	55.4	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	20.4	°C	68.72	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Large High Rise	**> 9,300 m² (100,000 ft²)**		**Lower Mainland**
Baseline			

LIGHTING

GENERAL (Linear Fluorescent) LIGHTING

Light Level	160	Lux	14.9	ft-candles
Floor Fraction (GLFF)	0.10			
Connected Load	4.6	W/m²	0.4	W/ft²
Occ. Period(Hrs./yr.)	3400			
Unocc. Period(Hrs./yr.)	5360			
Usage During Occupied Period	90%			
Usage During Unoccupied Period	90%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	50	100	200	300	Total
% Distribution	0%	60%	20%	20%	100%
Weighted Average					**160**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			60.0%	0%	40.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	0.3
	MJ/m².yr	13

ARCHITECTURAL (Incandescent & replacements) LIGHTING

Light Level	130	Lux	12.1	ft-candles
Floor Fraction (ALFF)	0.90			
Connected Load	13.7	W/m²	1.3	W/ft²
Occ. Period(Hrs./yr.)	2900			
Unocc. Period(Hrs./yr.)	5860			
Usage During Occupied Period	25%			
Usage During Unoccupied Period	20%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	50	200	300	500	Total
% Distribution	60%	20%	20%	0%	100%
Weighted Average					**130**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	60%	40%					0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI	kWh/ft².yr	2.2
	MJ/m².yr	84

EUI = Load X Hrs. X SF X GLFF

SPECIAL PURPOSE LIGHTING

Light Level	0.00	Lux	0.0	ft-candles
Floor Fraction (HBLFF)	0.00			
Connected Load	0.0	W/m²	0.0	W/ft²
Occ. Period(Hrs./yr.)	4000			
Unocc. Period(Hrs./yr.)	4760			
Usage During Occupied Period	0%			
Usage During Unoccupied Period	100%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 | 1.00

Light Level (Lux)	300	500	700	1000	Total
% Distribution		0%	0%	0%	0%
Weighted Average					**0**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)								0.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	0.0
	MJ/m².yr	0

TOTAL LIGHTING

Overall LPD	12.80 W/m²	EUI TOTAL kWh/ft².yr	2.5
	1.19 W/ft²	MJ/m².yr	97

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Servers	Plug Loads
Measured Power (W/device)	45	57	100	200	50	
Density (device/occupant)	0.6	0.6	0	0	0.00	
Connected Load	0.7 W/m²	0.9 W/m²	0.0 W/m²	0.0 W/m²	0.5 W/m²	1.3 W/m²
	0.1 W/ft²	0.1 W/ft²	0.00 W/ft²	0.00 W/ft²	0.05 W/ft²	0.12 W/ft²
Diversity Occupied Period	0%	0%	90%	90%	100%	40%
Diversity Unoccupied Period	50%	50%	50%	10%	100%	85%
Operation Occ. Period (hrs./year)	2900	2900	2600	2600	2600	3000
Operation Unocc. Period (hrs./year)	5860	5860	6160	6160	6160	5760

Total end-use load (occupied period)	1.0 W/m²	0.1 W/ft²
Total end-use load (unocc. period)	2.4 W/m²	0.2 W/ft²
Usage during occupied period	100%	
Usage during unoccupied period	231%	

Computer Equipment	EUI	kWh/ft².yr	0.84
		MJ/m².yr	32.38
Plug Loads	EUI	kWh/ft².yr	0.74
		MJ/m².yr	28.53

FOOD SERVICE EQUIPMENT

Provide description below:

Electric stoves (at 417 kWh/yr), etc.

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	0.3	EUI	kWh/ft².yr	0.7
	MJ/m².yr	10.0		MJ/m².yr	27.0

REFRIGERATION

Provide description below:

Residential refrigerators (560 kWh/yr) and freezers (370 kWh/yr)

EUI	kWh/ft².yr	0.8
	MJ/m².yr	30.0

MISCELLANEOUS

Provide description below:

Dryers, pools, fireplaces

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	1.0	EUI	kWh/ft².yr	0.0
	MJ/m².yr	40.0		MJ/m².yr	0.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large High Rise	> 9,300 m² (100,000 ft²)		Lower Mainland
Baseline			

SPACE HEATING

Heating Plant Type

							Electric			Other	
				Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	35%	20%	5%	20%	5%	0%	3%	3%	9%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff.) (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	22.1 W/m²	7.0 Btu/hr.ft²	
Seasonal Heating Load (Tertiary Load)	255 MJ/m².yr	6.6 kWh/ft².yr	
Sizing Factor	1.00		
Electric Fuel Share	15.0%	Fossil Fuel Share	85.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	5.2
MJ/m².yr	200

Gas EUI	
kWh/ft².yr	8.5
MJ/m².yr	330

Market Composite EUI	
kWh/ft².yr	8.0
MJ/m².yr	311

SPACE COOLING

A/C Plant Type

			WSHP			Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	1.0%	0.0%		5.0%	94.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7 °C	44.6 °F
Condenser Water	30 °C	86 °F
Supply Air	13.0 °C	55.4 °F

Peak Cooling Load	6 W/m²	2 Btu/hr.ft²	6521 ft²/Ton
Seasonal Cooling Load (Tertiary Load)	75.5 MJ/m².yr	1.9 kWh/ft².yr	

Sizing Factor 0.15 — Operation (occ. period) 3000 hrs/year — Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C) 11.0%

Electric Fuel Share 100.0% — Gas Fuel Share 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	0.5
MJ/m².yr	19

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	0.5
MJ/m².yr	19

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	25%				50%
Eff./COP	0.65				0.75

	Fossil		Elec. Res.
Fuel Share	75%		25%
Blended Efficiency	0.72		1.00

Service Hot Water load (MJ/m².yr) (Tertiary Load) 200.0

Wetting Use Percentage 80%

All Electric EUI	
kWh/ft².yr	5.2
MJ/m².yr	200

Fossil Fuel EUI	
kWh/ft².yr	7.2
MJ/m².yr	279

Market Composite EUI	
kWh/ft².yr	6.7
MJ/m².yr	259.3

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **Large High Rise** **Baseline**

SIZE: **> 9,300 m² (100,000 ft²)**

VINTAGE:

REGION: **Lower Mainland**

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	0.3	L/s.m²	0.05	CFM/ft²
System Static Pressure CAV	625	Pa	2.5	wg
System Static Pressure VAV	0	Pa	0.0	wg
Fan Efficiency	52%			
Fan Motor Efficiency	90%			
Sizing Factor	1.00			
Fan Design Load CAV	0.3	W/m²	0.03	W/ft²
Fan Design Load VAV	0.0	W/m²	0.00	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	100%	0%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	75%	25%	75%	25%

Comments:

EXHAUST FANS

Washroom Exhaust	50	L/s.washroom	106	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m²	0.02	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.2	L/s.m²	0.04	CFM/ft²
Exhaust System Static Pressure	125	Pa	0.5	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.1	W/m²	0.01	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.000	kW/kW	0.00	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	0.00	W/m²	0.00	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.000	L/s.m²	0.000	U.S. gpm/ft²
Pump Head Pressure	0	kPa	0	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.00	W/m²	0.00	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.000	L/s.m²	0.0004	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.0	W/m²	0.00	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	2.5	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	0.9	kWh/m².yr
Condenser Pump Energy Consumption	0.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.0	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	0.2	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI	kWh/ft².yr	0.3
	MJ/m².yr	13.2

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large High Rise	> 9,300 m² (100,000 ft²)		Lower Mainland
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	Electricity:	8.9	kWh/ft².yr	343.1	MJ/m².yr	Fossil Fue	13.9	kWh/ft².yr	540.0	MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL (Linear Fluorescent) LIGHT	0.3	13.1
ARCHITECTURAL (Incandescent & re	2.2	84.3
SPECIAL PURPOSE LIGHTING	0.0	0.0
OTHER PLUG LOADS	0.7	28.5
HVAC FANS & PUMPS	0.3	13.2
REFRIGERATION	0.8	30.0
COMPUTER EQUIPMENT	0.8	32.4
ELEVATORS	0.4	15.5
OUTDOOR LIGHTING	0.4	17.0

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.8	30.0	7.2	280.7
SPACE COOLING	0.1	2.1	0.0	0.0
DOMESTIC HOT WATER	1.3	50.0	5.4	209.3
FOOD SERVICE EQUIPMENT	0.7	27.0	0.3	10.0
MISCELLANEOUS	0.0	0.0	1.0	40.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Medium Apartment			**Lower Mainland**
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.81	W/m².°C	0.14	Btu/hr.ft² . °F	Typical Building Size	8,000	m²	86,080	ft²
Roof U value (W/m².°C)	0.56	W/m².°C	0.10	Btu/hr.ft² . °F	Typical Footprint (m²)	1,600	m²	17,216	ft²
Glazing U value (W/m².°C)	4.26	W/m².°C	0.75	Btu/hr.ft² . °F	Footprint Aspect Ratio (L:W)	3			
					Percent Conditioned Space	100%			
					Percent Conditioned Space Defined as Exterior Zone	45%			
Window/Wall Ratio (WIWAR) (%)	0.25								
Shading Coefficient (SC)	0.65				Typical # Stories	5			
					Floor to Floor Height (m)	3.7	m	12.0	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	100%		0%		0%		0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	40	m²/person	430	ft²/person	%OA	100.00%
Occupancy Schedule Occ. Period	25%					
Occupancy Schedule Unocc. Period	80%					
Fresh Air Requirements or Outside Air	10	L/s.person	21	CFM/person		

Fresh Air Control Type *(enter a 1, 2 or 3) 3
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right:	0%			
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation	0.25	L/s.m²	0.05	CFM/ft²
	75%	operation (%)		

Sizing Factor	1			
Total Air Circulation or Design Air Flow	0.25	L/s.m²	0.05	CFM/ft²
Infiltration Rate	0.05	L/s.m²	0.01	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)		L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	1,033,682	
Peak Zone Sensible Load	628,663	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	29,245	
Total air circulation or Design air	1.73	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	20	°C	68	°F	13	°C	55.4	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	20.4	°C	68.72	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **Medium Apartment** **Baseline**

SIZE:

VINTAGE:

REGION: **Lower Mainland**

LIGHTING

GENERAL (Linear Fluorescent) LIGHTING

Light Level	160	Lux	14.9	ft-candles
Floor Fraction (GLFF)	0.10			
Connected Load	4.6	W/m²	0.4	W/ft²

Occ. Period(Hrs./yr.)	3400
Unocc. Period(Hrs./yr.)	5360
Usage During Occupied Period	90%
Usage During Unoccupied Period	90%

Light Level (Lux)	50	100	200	300	Total
% Distribution	0%	60%	20%	20%	100%
Weighted Average					**160**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			60.0%	0%	40.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

Fixture Cleaning:
Incidence of Practice
Interval years

Relamping Strategy & Incidence of Practice: Group | Spot

EUI	kWh/ft².yr	0.3
	MJ/m².yr	13

ARCHITECTURAL (Incandescent & replacements) LIGHTING

Light Level	130	Lux	12.1	ft-candles
Floor Fraction (ALFF)	0.90			
Connected Load	13.7	W/m²	1.3	W/ft²

Occ. Period(Hrs./yr.)	2900
Unocc. Period(Hrs./yr.)	5860
Usage During Occupied Period	25%
Usage During Unoccupied Period	20%

Light Level (Lux)	50	200	300	500	Total
% Distribution	60%	20%	20%	0%	100%
Weighted Average					**130**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	60%	40%					0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

Fixture Cleaning:
Incidence of Practice
Interval years

Relamping Strategy & Incidence of Practice: Group | Spot

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	2.2
	MJ/m².yr	84

SPECIAL PURPOSE LIGHTING

Light Level	0.00	Lux	0.0	ft-candles
Floor Fraction (HBLFF)	0.00			
Connected Load	0.0	W/m²	0.0	W/ft²

Floor fraction check: should = 1.00 | 1.00

Occ. Period(Hrs./yr.)	4000
Unocc. Period(Hrs./yr.)	4760
Usage During Occupied Period	0%
Usage During Unoccupied Period	100%

Light Level (Lux)	300	500	700	1000	Total
% Distribution		0%	0%	0%	0%
Weighted Average					**0**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)								0.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

Fixture Cleaning:
Incidence of Practice
Interval years

Relamping Strategy & Incidence of Practice: Group | Spot

EUI	kWh/ft².yr	0.0
	MJ/m².yr	0

TOTAL LIGHTING

Overall LPD	12.80 W/m²	EUI TOTAL	kWh/ft².yr	2.5
	1.19 W/ft²		MJ/m².yr	97

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Servers	Plug Loads
Measured Power (W/device)	45	57	100	200	50	
Density (device/occupant)	0.6	0.6	0	0	0.00	
Connected Load	0.7 W/m²	0.9 W/m²	0.0 W/m²	0.0 W/m²	0.5 W/m²	1.3 W/m²
	0.1 W/ft²	0.1 W/ft²	0.00 W/ft²	0.00 W/ft²	0.05 W/ft²	0.12 W/ft²
Diversity Occupied Period	0%	0%	90%	90%	100%	40%
Diversity Unoccupied Period	50%	50%	50%	10%	100%	85%
Operation Occ. Period (hrs./year)	2900	2900	2600	2600	2600	3000
Operation Unocc. Period (hrs./year)	5860	5860	6160	6160	6160	5760

Total end-use load (occupied period)	1.0 W/m²	0.1 W/ft²
Total end-use load (unocc. period)	2.4 W/m²	0.2 W/ft²
Usage during occupied period	100%	
Usage during unoccupied period	231%	

Computer Equipment	EUI	kWh/ft².yr	0.84
		MJ/m².yr	32.38
Plug Loads	EUI	kWh/ft².yr	0.74
		MJ/m².yr	28.53

FOOD SERVICE EQUIPMENT

Provide description below:
Electric stoves (at 417 kWh/yr), etc.

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	0.1	EUI	kWh/ft².yr	0.7
	MJ/m².yr	5.0		MJ/m².yr	27.0

REFRIGERATION

Provide description below:
Residential refrigerators (560 kWh/yr) and freezers (370 kWh/yr)

EUI	kWh/ft².yr	0.8
	MJ/m².yr	30.0

MISCELLANEOUS

Provide description below:
pools, dryers, fireplaces, bbq etc

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	0.8	EUI	kWh/ft².yr	0.0
	MJ/m².yr	30.0		MJ/m².yr	0.0

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **SIZE:** **VINTAGE:** **REGION:**
Medium Apartment **Lower Mainland**
Baseline

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	30%	10%	5%	20%	15%	0%	3%	3%	14%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff. (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	22.4 W/m²	7.1 Btu/hr.ft²	
Seasonal Heating Load (Tertiary Load)	260 MJ/m².yr	6.7 kWh/ft².yr	
Sizing Factor	1.00		
Electric Fuel Share	20.0%	Fossil Fuel Share	80.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	kWh/ft².yr	5.6
	MJ/m².yr	218
Gas EUI	kWh/ft².yr	8.7
	MJ/m².yr	336
Market Composite EUI	kWh/ft².yr	8.1
	MJ/m².yr	312

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	0.0%	0.0%		0.0%	100.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7 °C	44.6 °F
Condenser Water	30 °C	86 °F
Supply Air	13.0 °C	55.4 °F

Peak Cooling Load	6 W/m²	2 Btu/hr.ft²	6662 ft²/Ton
Seasonal Cooling Load (Tertiary Load)	72.1 MJ/m².yr	1.9 kWh/ft².yr	

Sizing Factor 0.15 Operation (occ. period) 3000 hrs/year Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C) 11.0%

Electric Fuel Share 100.0% Gas Fuel Share 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	kWh/ft².yr	0.5
	MJ/m².yr	19
Natural Gas EUI	kWh/ft².yr	0.0
	MJ/m².yr	0
Market Composite EUI	kWh/ft².yr	0.5
	MJ/m².yr	19

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	50%				20%
Eff./COP	0.65				0.75

	Fossil	Elec. Res.
Fuel Share	70%	30%
Blended Efficiency	0.68	1.00

Service Hot Water load (MJ/m².yr) (Tertiary Load) 180.0

Wetting Use Percentage 80%

	All Electric EUI	Fossil Fuel EUI	Market Composite EUI
kWh/ft².yr	4.6	6.8	6.2
MJ/m².yr	180	265	239.7

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Apartment			Lower Mainland
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	0.3	L/s.m²	0.05	CFM/ft²
System Static Pressure CAV	625	Pa	2.5	wg
System Static Pressure VAV	0	Pa	0.0	wg
Fan Efficiency	52%			
Fan Motor Efficiency	90%			
Sizing Factor	1.00			
Fan Design Load CAV	0.3	W/m²	0.03	W/ft²
Fan Design Load VAV	0.0	W/m²	0.00	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	100%	0%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	75%	25%	75%	25%

Comments:

EXHAUST FANS

Washroom Exhaust	50	L/s.washroom	106	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m²	0.01	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.2	L/s.m²	0.03	CFM/ft²
Exhaust System Static Pressure	125	Pa	0.5	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.1	W/m²	0.01	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.000	kW/kW	0.00	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	0.00	W/m²	0.00	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.000	L/s.m²	0.000	U.S. gpm/ft²
Pump Head Pressure	0	kPa	0	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.00	W/m²	0.00	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.000	L/s.m²	0.0004	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.0	W/m²	0.00	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	2.5	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	0.8	kWh/m².yr
Condenser Pump Energy Consumption	0.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.0	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	0.2	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI	kWh/ft².yr	0.3
	MJ/m².yr	12.7

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Apartment			Lower Mainland
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**9.2**	kWh/ft².yr	**356.2**	MJ/m².yr		
	Fossil Fue	**12.6**	kWh/ft².yr	**489.6**	MJ/m².yr		

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL (Linear Fluorescent) LIGHT	0.3	13.1
ARCHITECTURAL (Incandescent & re	2.2	84.3
SPECIAL PURPOSE LIGHTING	0.0	0.0
OTHER PLUG LOADS	0.7	28.5
HVAC FANS & PUMPS	0.3	12.7
REFRIGERATION	0.8	30.0
COMPUTER EQUIPMENT	0.8	32.4
ELEVATORS	0.3	11.6
OUTDOOR LIGHTING	0.4	17.0

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	1.1	43.6	6.9	268.9
SPACE COOLING	0.1	2.0	0.0	0.0
DOMESTIC HOT WATER	1.4	54.0	4.8	185.7
FOOD SERVICE EQUIPMENT	0.7	27.0	0.1	5.0
MISCELLANEOUS	0.0	0.0	0.8	30.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Large Office	**> 9,300 m² (100,000 ft²)**		**Vancouver Island**
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.91	W/m².°C	0.16	Btu/hr.ft² . °F	
Roof U value (W/m².°C)	0.61	W/m².°C	0.11	Btu/hr.ft² . °F	
Glazing U value (W/m².°C)	4.29	W/m².°C	0.75	Btu/hr.ft² . °F	
Window/Wall Ratio (WIWAR) (%)	0.41				
Shading Coefficient (SC)	0.58				

Typical Building Size	21,365	m²	229,887	ft²
Typical Footprint (m²)	1,526	m²	16,421	ft²
Footprint Aspect Ratio (L:W)	1			
Percent Conditioned Space	100%			
Percent Conditioned Space Defined as Exterior Zone	45%			
Typical # Stories	14			
Floor to Floor Height (m)	3.7	m	12.0	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	50%		0%		50%		0%		100%
Min. Air Flow (%)					40%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	26	m²/person	274	ft²/person
Occupancy Schedule Occ. Period	90%			
Occupancy Schedule Unocc. Period	0%			
Fresh Air Requirements or Outside Air	20	L/s.person	42	CFM/person

%OA 15.43%

Fresh Air Control Type *(enter a 1, 2 or 3) 1
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right:
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation L/s.m² 0.00 CFM/ft² operation (%)

Sizing Factor	1.6			
Total Air Circulation or Design Air Flow	5.08	L/s.m²	1.00	CFM/ft²
Infiltration Rate	0.70	L/s.m²	0.14	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)		L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	6,571,023	
Peak Zone Sensible Load	3,092,263	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	143,852	
Total air circulation or Design air	5.08	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	24	°C	75.2	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				98%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	19.5	°C	67.1	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning — Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Office	> 9,300 m² (100,000 ft²)		Vancouver Island
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	600	Lux	55.8	ft-candles
Floor Fraction (GLFF)	0.90			
Connected Load	16.6	W/m²	1.5	W/ft²

Occ. Period(Hrs./yr.)	2900
Unocc. Period(Hrs./yr.)	5860
Usage During Occupied Period	95%
Usage During Unoccupied Period	35%

Light Level (Lux)	500	600	700	800				Total
% Distribution	25%	50%	25%	0%				100%
Weighted Average								**600**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			37.5%	0%	62.5%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

Fixture Cleaning:
Incidence of Practice
Interval years

Relamping Strategy & Incidence of Practice: Group | Spot

EUI	kWh/ft².yr	6.7
	MJ/m².yr	259

ARCHITECTURAL LIGHTING

Light Level	350	Lux	32.5	ft-candles
Floor Fraction (ALFF)	0.10			
Connected Load	29.7	W/m²	2.8	W/ft²

Occ. Period(Hrs./yr.)	3400
Unocc. Period(Hrs./yr.)	5360
Usage During Occupied Period	95%
Usage During Unoccupied Period	50%

Light Level (Lux)	200	300	400	500				Total
% Distribution	10%	40%	40%	10%				100%
Weighted Average								**350**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	40%	60%					0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

Fixture Cleaning:
Incidence of Practice
Interval years

Relamping Strategy & Incidence of Practice: Group | Spot

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	1.6
	MJ/m².yr	63

SPECIAL PURPOSE LIGHTING

Light Level	0.00	Lux	0.0	ft-candles
Floor Fraction (HBLFF)	0.00			
Connected Load	0.0	W/m²	0.0	W/ft²

Floor fraction check: should = 1.00 — 1.00

Occ. Period(Hrs./yr.)	4000
Unocc. Period(Hrs./yr.)	4760
Usage During Occupied Period	0%
Usage During Unoccupied Period	100%

Light Level (Lux)	300	500	700	1000				Total
% Distribution		0%	0%	0%				0%
Weighted Average								**0**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)								0.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

Fixture Cleaning:
Incidence of Practice
Interval years

Relamping Strategy & Incidence of Practice: Group | Spot

EUI	kWh/ft².yr	0.0
	MJ/m².yr	0

TOTAL LIGHTING

Overall LPD	17.94 W/m²	EUI TOTAL	kWh/ft².yr	8.3
	1.67 W/ft²		MJ/m².yr	322

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Servers	Plug Loads
Measured Power (W/device)	55	51	100	200	217	
Density (device/occupant)	0.9	0.9	0.15	0.1	0.06	
Connected Load	1.9 W/m²	1.8 W/m²	0.6 W/m²	0.8 W/m²	0.5 W/m²	2.5 W/m²
	0.2 W/ft²	0.2 W/ft²	0.05 W/ft²	0.07 W/ft²	0.05 W/ft²	0.23 W/ft²
Diversity Occupied Period	90%	90%	90%	90%	100%	90%
Diversity Unoccupied Period	50%	50%	50%	50%	100%	25%
Operation Occ. Period (hrs./year)	2500	2500	2500	2500	2500	3000
Operation Unocc. Period (hrs./year)	6260	6260	6260	6260	6260	5760

Total end-use load (occupied period)	7.3 W/m²	0.7 W/ft²
Total end-use load (unocc. period)	3.7 W/m²	0.3 W/ft²

Usage during occupied period	100%
Usage during unoccupied period	50%

Computer Equipment	EUI	kWh/ft².yr	2.96
		MJ/m².yr	114.76
Plug Loads	EUI	kWh/ft².yr	0.96
		MJ/m².yr	37.26

FOOD SERVICE EQUIPMENT

Provide description below:
Cafeteria

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	0.3	EUI	kWh/ft².yr	0.1
	MJ/m².yr	10.0		MJ/m².yr	3.0

REFRIGERATION

Provide description below:
Cafeteria

EUI	kWh/ft².yr	0.1
	MJ/m².yr	4.0

MISCELLANEOUS

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	0.5	EUI	kWh/ft².yr	0.0
	MJ/m².yr	20.0		MJ/m².yr	0.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Large Office	**> 9,300 m² (100,000 ft²)**		**Vancouver Island**
Baseline			

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	65%	15%	5%	10%	0%	0%	1%	1%	3%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff.) (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	30.0 W/m²	9.5 Btu/hr.ft²	
Seasonal Heating Load (Tertiary Load)	239 MJ/m².yr	6.2 kWh/ft².yr	
Sizing Factor	1.00		
Electric Fuel Share	5.0%	Fossil Fuel Share	95.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	4.8
MJ/m².yr	188

Gas EUI	
kWh/ft².yr	8.1
MJ/m².yr	313

Market Composite EUI	
kWh/ft².yr	7.9
MJ/m².yr	307

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	56.0%	24.0%		5.0%	15.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7 °C	44.6 °F
Condenser Water	30 °C	86 °F
Supply Air	14.0 °C	57.2 °F

Peak Cooling Load	90 W/m²	29 Btu/hr.ft²	420 ft²/Ton
Seasonal Cooling Load (Tertiary Load)	162.4 MJ/m².yr	4.2 kWh/ft².yr	

Sizing Factor 1.00 Operation (occ. period) 3000 hrs/year Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C) 90.0%

Electric Fuel Share 100.0% Gas Fuel Share 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	1.6
MJ/m².yr	62

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	1.6
MJ/m².yr	62

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	40%				20%
Eff./COP	0.65				0.75

	Fossil	Elec. Res.
Fuel Share	60%	40%
Blended Efficiency	0.68	0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 40.0

Wetting Use Percentage 90%

All Electric EUI	
kWh/ft².yr	1.1
MJ/m².yr	44

Fossil Fuel EUI	
kWh/ft².yr	1.5
MJ/m².yr	59

Market Composite EUI	
kWh/ft².yr	1.4
MJ/m².yr	52.7

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Large Office	**> 9,300 m² (100,000 ft²)**		**Vancouver Island**
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	5.1	L/s.m²	1.00	CFM/ft²
System Static Pressure CAV	875	Pa	3.5	wg
System Static Pressure VAV	875	Pa	3.5	wg
Fan Efficiency	52%			
Fan Motor Efficiency	90%			
Sizing Factor	1.00			
Fan Design Load CAV	9.5	W/m²	0.88	W/ft²
Fan Design Load VAV	9.5	W/m²	0.88	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	50%	50%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	50%	50%	50%	50%
Comments:				

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m²	0.03	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.2	L/s.m²	0.05	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	40%			
Fan Motor Efficiency	80%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.2	W/m²	0.02	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.020	kW/kW	0.07	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	1.80	W/m²	0.17	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.005	L/s.m²	0.007	U.S. gpm/ft²
Pump Head Pressure	90	kPa	30	ft
Pump Efficiency	55%			
Pump Motor Efficiency	90%			
Sizing Factor	1.0			
Pump Connected Load	0.87	W/m²	0.08	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.004	L/s.m²	0.0057	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	150	kPa	50	ft		
Pump Efficiency	55%					
Pump Motor Efficiency	90%					
Sizing Factor	0.8					
Pump Connected Load	0.9	W/m²	0.09	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	45.5	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	1.1	kWh/m².yr
Condenser Pump Energy Consumption	2.7	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.9	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	4.7	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI		
	kWh/ft².yr	5.1
	MJ/m².yr	197.8

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Large Office	**> 9,300 m² (100,000 ft²)**		**Vancouver Island**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**20.5** kWh/ft².yr	**794.0** MJ/m².yr	**Fossil Fue**	**9.4** kWh/ft².yr **362.5** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	6.7	259.0
ARCHITECTURAL LIGHTING	1.6	63.3
SPECIAL PURPOSE LIGHTING	0.0	0.0
OTHER PLUG LOADS	1.0	37.3
HVAC FANS & PUMPS	5.1	197.8
REFRIGERATION	0.1	4.0
COMPUTER EQUIPMENT	3.0	114.8
ELEVATORS	0.4	15.5
OUTDOOR LIGHTING	0.4	17.0

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.2	9.4	7.7	297.3
SPACE COOLING	1.4	55.5	0.0	0.0
DOMESTIC HOT WATER	0.5	17.6	0.9	35.1
FOOD SERVICE EQUIPMENT	0.1	3.0	0.3	10.0
MISCELLANEOUS	0.0	0.0	0.5	20.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Office	50,000 to 100,000 ft²		Vancouver Island
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.88	W/m².°C	0.15	Btu/hr.ft² . °F	Typical Building Size	6,777	m²	72,921	ft²
Roof U value (W/m².°C)	0.61	W/m².°C	0.11	Btu/hr.ft² . °F	Typical Footprint (m²)	753	m²	8,102	ft²
Glazing U value (W/m².°C)	4.29	W/m².°C	0.75	Btu/hr.ft² . °F	Footprint Aspect Ratio (L:W)	1			
					Percent Conditioned Space	100%			
					Percent Conditioned Space Defined as Exterior Zone	45%			
Window/Wall Ratio (WIWAR) (%)	0.36								
Shading Coefficient (SC)	0.58				Typical # Stories	9			
					Floor to Floor Height (m)	3.7	m	12.0	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	75%		0%		25%		0%		100%
Min. Air Flow (%)					60%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	26	m²/person	274	ft²/person	%OA	12.05%
Occupancy Schedule Occ. Period	90%					
Occupancy Schedule Unocc. Period	0%					
Fresh Air Requirements or Outside Air	15	L/s.person	32	CFM/person		

Fresh Air Control Type *(enter a 1, 2 or 3) | 1 | If Fresh Air Control Type = "2" enter % FA. to the right:

(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air) | If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation | L/s.m² | 0.00 CFM/ft² | operation (%)

Sizing Factor	1.5			
Total Air Circulation or Design Air Flow	4.88	L/s.m²	0.96	CFM/ft²

Separate Make-up air unit (100% OA) | L/s.m² | 0.00 CFM/ft²

Infiltration Rate	0.70	L/s.m²	0.14	CFM/ft²	Operation occupied period	50%
(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)					Operation unoccupied period	50%

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	1,847,559	
Peak Zone Sensible Load	1,004,711	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	46,739	
Total air circulation or Design air	4.88	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	24	°C	75.2	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				98%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	19.5	°C	67.1	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning | Changes/Year |

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Office	50,000 to 100,000 ft²		Vancouver Island
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	600	Lux	55.8	ft-candles
Floor Fraction (GLFF)	0.92			
Connected Load	16.6	W/m²	1.5	W/ft²
Occ. Period(Hrs./yr.)	2900			
Unocc. Period(Hrs./yr.)	5860			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	30%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	500	600	700	800			Total
% Distribution	25%	50%	25%	0%			100%
Weighted Average							**600**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			37.5%		62.5%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	6.4
	MJ/m².yr	249

ARCHITECTURAL LIGHTING

Light Level	350	Lux	32.5	ft-candles
Floor Fraction (ALFF)	0.07			
Connected Load	31.5	W/m²	2.9	W/ft²
Occ. Period(Hrs./yr.)	3400			
Unocc. Period(Hrs./yr.)	5360			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	40%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	200	300	400	500			Total
% Distribution	10%	40%	40%	10%			100%
Weighted Average							**350**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	45%	55%					0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	1.1
	MJ/m².yr	43

SPECIAL PURPOSE LIGHTING

Light Level	0.00	Lux	0.0	ft-candles
Floor Fraction (HBLFF)	0.01			
Connected Load	0.0	W/m²	0.0	W/ft²
Occ. Period(Hrs./yr.)	3400			
Unocc. Period(Hrs./yr.)	5360			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	40%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 | 1.00

Light Level (Lux)	300	500	700	1000			Total
% Distribution		0%	0%	0%			0%
Weighted Average							**0**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)						50%	50%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	0.0
	MJ/m².yr	0

TOTAL LIGHTING

Overall LPD	17.51 W/m²	EUI TOTAL	kWh/ft².yr	7.5
	1.63 W/ft²		MJ/m².yr	291

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Servers	Plug Loads
Measured Power (W/device)	55	51	100	200	217	
Density (device/occupant)	0.9	0.9	0.15	0.1	0.06	
Connected Load	1.9 W/m²	1.8 W/m²	0.6 W/m²	0.8 W/m²	0.5 W/m²	1 W/m²
	0.2 W/ft²	0.2 W/ft²	0.05 W/ft²	0.07 W/ft²	0.05 W/ft²	0.09 W/ft²
Diversity Occupied Period	90%	90%	90%	90%	100%	80%
Diversity Unoccupied Period	50%	50%	50%	50%	100%	25%
Operation Occ. Period (hrs./year)	2500	2500	2500	2500	2500	2500
Operation Unocc. Period (hrs./year)	6260	6260	6260	6260	6260	6260

Total end-use load (occupied period)	5.9 W/m²	0.5 W/ft²
Total end-use load (unocc. period)	3.3 W/m²	0.3 W/ft²
Usage during occupied period	100%	
Usage during unoccupied period	56%	

Computer Equipment	EUI	kWh/ft².yr	2.96
		MJ/m².yr	114.76
Plug Loads	EUI	kWh/ft².yr	0.33
		MJ/m².yr	12.83

FOOD SERVICE EQUIPMENT

Provide description below:

Lunch room/cafeteria/restaurant

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	0.3	EUI	kWh/ft².yr	0.1
	MJ/m².yr	10.0		MJ/m².yr	4.0

REFRIGERATION

Provide description below:

Lunch room/cafeteria/restaurant

EUI	kWh/ft².yr	0.1
	MJ/m².yr	4.0

MISCELLANEOUS

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	0.5	EUI	kWh/ft².yr	0.0
	MJ/m².yr	20.0		MJ/m².yr	0.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Office	50,000 to 100,000 ft²		Vancouver Island
Baseline			

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	30%	10%	5%	45%	0%	0%	3%	1%	6%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff. (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	33.1 W/m²	10.5 Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	289 MJ/m².yr	7.5 kWh/ft².yr
Sizing Factor	1.00	
Electric Fuel Share	10.0%	Fossil Fuel Share 90.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	kWh/ft².yr	6.0
	MJ/m².yr	234
Gas EUI	kWh/ft².yr	9.8
	MJ/m².yr	379
Market Composite EUI	kWh/ft².yr	9.4
	MJ/m².yr	365

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	5.0%	5.0%	10.0%	30.0%	50.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7 °C	44.6 °F
Condenser Water	30 °C	86 °F
Supply Air	14.0 °C	57.2 °F

Peak Cooling Load	80 W/m²	25 Btu/hr.ft²	474 ft²/Ton
Seasonal Cooling Load (Tertiary Load)	143.2 MJ/m².yr	3.7 kWh/ft².yr	

Sizing Factor 1.00   Operation (occ. period) 3000 hrs/year   Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C) 90.0%

Electric Fuel Share 100.0%   Gas Fuel Share 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	kWh/ft².yr	1.6
	MJ/m².yr	63
Natural Gas EUI	kWh/ft².yr	0.0
	MJ/m².yr	0
Market Composite EUI	kWh/ft².yr	1.6
	MJ/m².yr	63

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	50%				10%
Eff./COP	0.65				0.75

	Fossil	Elec. Res.
Fuel Share	60%	40%
Blended Efficiency	0.67	0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 35.0

Wetting Use Percentage 90%

	All Electric EUI	Fossil Fuel EUI	Market Composite EUI
kWh/ft².yr	1.0	1.4	1.2
MJ/m².yr	38	53	46.9

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Office	50,000 to 100,000 ft²		Vancouver Island
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	4.9	L/s.m²	0.96	CFM/ft²
System Static Pressure CAV	750	Pa	3.0	wg
System Static Pressure VAV	750	Pa	3.0	wg
Fan Efficiency	52%			
Fan Motor Efficiency	85%			
Sizing Factor	1.00			
Fan Design Load CAV	8.3	W/m²	0.77	W/ft²
Fan Design Load VAV	8.3	W/m²	0.77	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	75%	25%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	75%	25%	75%	25%
Comments:				

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.3	L/s.m²	0.05	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.4	L/s.m²	0.07	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	40%			
Fan Motor Efficiency	80%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.3	W/m²	0.03	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.018	kW/kW	0.06	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	1.43	W/m²	0.13	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.004	L/s.m²	0.006	U.S. gpm/ft²
Pump Head Pressure	90	kPa	30	ft
Pump Efficiency	55%			
Pump Motor Efficiency	90%			
Sizing Factor	1.0			
Pump Connected Load	0.77	W/m²	0.07	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.003	L/s.m²	0.0051	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	150	kPa	50	ft		
Pump Efficiency	55%					
Pump Motor Efficiency	90%					
Sizing Factor	0.5					
Pump Connected Load	0.5	W/m²	0.05	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	57.1	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	2.1	kWh/m².yr
Condenser Pump Energy Consumption	1.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.7	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	2.6	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI		
	kWh/ft².yr	5.9
	MJ/m².yr	228.8

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Medium Office	**50,000 to 100,000 ft²**		**Vancouver Island**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES: **Electricity:** **20.1** kWh/ft².yr **779.6** MJ/m².yr **Fossil Fuel** **10.4** kWh/ft².yr **402.7** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	6.4	248.6
ARCHITECTURAL LIGHTING	1.1	42.7
SPECIAL PURPOSE LIGHTING	0.0	0.0
OTHER PLUG LOADS	0.3	12.8
HVAC FANS & PUMPS	5.9	228.8
REFRIGERATION	0.1	4.0
COMPUTER EQUIPMENT	3.0	114.8
ELEVATORS	0.3	11.6
OUTDOOR LIGHTING	0.4	17.0

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.6	23.4	8.8	341.2
SPACE COOLING	1.5	56.5	0.0	0.0
DOMESTIC HOT WATER	0.4	15.4	0.8	31.5
FOOD SERVICE EQUIPMENT	0.1	4.0	0.3	10.0
MISCELLANEOUS	0.0	0.0	0.5	20.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Retail	**> 100,000 ft²**		**Vancouver Island**
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.73	W/m².°C	0.13	Btu/hr.ft² . °F	Typical Building Size	24,000	m²	258,240	ft²
Roof U value (W/m².°C)	0.61	W/m².°C	0.11	Btu/hr.ft² . °F	Typical Footprint (m²)	24,000	m²	258,240	ft²
Glazing U value (W/m².°C)	4.82	W/m².°C	0.85	Btu/hr.ft² . °F	Footprint Aspect Ratio (L:W)	15			
					Percent Conditioned Space	100%			
					Percent Conditioned Space Defined as Exterior Zone	40%			
Window/Wall Ratio (WIWAR) (%)	0.10								
Shading Coefficient (SC)	0.75				Typical # Stories	1			
					Floor to Floor Height (m)	4.6	m	15.0	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	95%		0%		5%		0%		100%
Min. Air Flow (%)					60%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	45	m²/person	484	ft²/person
Occupancy Schedule Occ. Period	90%			
Occupancy Schedule Unocc. Period	0%			
Fresh Air Requirements or Outside Air	40	L/s.person	85	CFM/person

%OA 17.66%

Fresh Air Control Type *(enter a 1, 2 or 3) 1
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right:	0%			
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation	0.5	L/s.m²	0.10	CFM/ft²
	50%	operation (%)		

Sizing Factor	1.8			
Total Air Circulation or Design Air Flow	5.03	L/s.m²	0.99	CFM/ft²
Infiltration Rate	0.70	L/s.m²	0.14	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	7,362,838	
Peak Zone Sensible Load	3,056,393	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	142,183	
Total air circulation or Design air	5.03	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	23	°C	73.4	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	21	°C	69.8	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Retail	> 100,000 ft²		Vancouver Island
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	525 Lux	48.8	ft-candles
Floor Fraction (GLFF)	0.55		
Connected Load	15.1 W/m²	1.4	W/ft²
Occ. Period(Hrs./yr.)	4100		
Unocc. Period(Hrs./yr.)	4660		
Usage During Occupied Period	95%		
Usage During Unoccupied Period	20%		
Fixture Cleaning:			
Incidence of Practice			
Interval	years		
Relamping Strategy & Incidence of Practice	Group	Spot	

Light Level (Lux)	500	600	700	800			Total
% Distribution	75%	25%	0%	0%			100%
Weighted Average							**525**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			60.0%	0%	40.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI kWh/ft².yr 3.7; MJ/m².yr 145

ARCHITECTURAL LIGHTING

Light Level	505 Lux	46.9	ft-candles
Floor Fraction (ALFF)	0.30		
Connected Load	61.0 W/m²	5.7	W/ft²
Occ. Period(Hrs./yr.)	4100		
Unocc. Period(Hrs./yr.)	4660		
Usage During Occupied Period	95%		
Usage During Unoccupied Period	30%		
Fixture Cleaning:			
Incidence of Practice			
Interval	years		
Relamping Strategy & Incidence of Practice	Group	Spot	

Light Level (Lux)	400	500	600	700			Total
% Distribution	25%	50%	20%	5%			100%
Weighted Average							**505**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	75%	25%					0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI kWh/ft².yr 9.0; MJ/m².yr 349

SPECIAL PURPOSE LIGHTING

Light Level	500.00 Lux	46.5	ft-candles
Floor Fraction (HBLFF)	0.15		
Connected Load	23.3 W/m²	2.2	W/ft²
Occ. Period(Hrs./yr.)	4100		
Unocc. Period(Hrs./yr.)	4660		
Usage During Occupied Period	95%		
Usage During Unoccupied Period	15%		
Fixture Cleaning:			
Incidence of Practice			
Interval	years		
Relamping Strategy & Incidence of Practice	Group	Spot	

Floor fraction check: should = 1.00 — 1.00

Light Level (Lux)	400	500	600	700			Total
% Distribution	40%	30%	20%	10%			100%
Weighted Average							**500**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)						100%		100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI kWh/ft².yr 1.5; MJ/m².yr 58

TOTAL LIGHTING — Overall LPD 26.64 W/m², 2.48 W/ft² — EUI TOTAL kWh/ft².yr 14.2; MJ/m².yr 552

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Servers	Plug Loads
Measured Power (W/device)	55	51	100	200	217	
Density (device/occupant)	0.648828	0.648828	0.01	0.01	0.03	
Connected Load	0.8 W/m²	0.7 W/m²	0.0 W/m²	0.0 W/m²	0.5 W/m²	1.75 W/m²
	0.1 W/ft²	0.1 W/ft²	0.00 W/ft²	0.00 W/ft²	0.05 W/ft²	0.16 W/ft²
Diversity Occupied Period	90%	90%	90%	90%	100%	90%
Diversity Unoccupied Period	50%	50%	50%	50%	100%	25%
Operation Occ. Period (hrs./year)	2000	2000	2600	2600	2600	4100
Operation Unocc. Period (hrs./year)	6760	6760	6160	6160	6160	4660

Total end-use load (occupied period)	3.5 W/m²	0.3 W/ft²
Total end-use load (unocc. period)	1.7 W/m²	0.2 W/ft²
Usage during occupied period	100%	
Usage during unoccupied period	50%	

Computer Equipment EUI kWh/ft².yr 1.18; MJ/m².yr 45.81

Plug Loads EUI kWh/ft².yr 0.79; MJ/m².yr 30.59

FOOD SERVICE EQUIPMENT

Provide description below:

Gas EUI: EUI kWh/ft².yr 0.3; MJ/m².yr 10.0

Electric EUI: EUI kWh/ft².yr 0.3; MJ/m².yr 10.0

REFRIGERATION

Provide description below:

Commercial refrigeration display cases

EUI kWh/ft².yr 0.3; MJ/m².yr 10.0

MISCELLANEOUS

Provide description below:

Gas EUI: EUI kWh/ft².yr 0.1; MJ/m².yr 5.0

Electric EUI: EUI kWh/ft².yr 0.0; MJ/m².yr 0.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **Large Retail** **Baseline**
SIZE: **> 100,000 ft²**
VINTAGE:
REGION: **Vancouver Island**

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	10%	8%	2%	60%	10%	0%	3%	2%	5%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff. (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load: 29.9 W/m² — 9.5 Btu/hr.ft²
Seasonal Heating Load (Tertiary Load): 261 MJ/m².yr — 6.7 kWh/ft².yr
Sizing Factor: 1.00

Electric Fuel Share: 10.0% — Fossil Fuel Share: 90.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	5.0
MJ/m².yr	194

Gas EUI	
kWh/ft².yr	8.9
MJ/m².yr	343

Market Composite EUI	
kWh/ft².yr	8.5
MJ/m².yr	328

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	10.0%	5.0%	0.0%	0.0%	85.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

	°C	°F
Chilled Water	7	44.6
Condenser Water	30	86
Supply Air	14.0	57.2

Peak Cooling Load: 90 W/m² — 29 Btu/hr.ft² — 421 ft²/Ton
Seasonal Cooling Load (Tertiary Load): 130.3 MJ/m².yr — 3.4 kWh/ft².yr

Sizing Factor: 1.00 — Operation (occ. period): 3000 hrs/year Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C): 80.0%

Electric Fuel Share: 100.0% — Gas Fuel Share: 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	1.4
MJ/m².yr	53

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	1.4
MJ/m².yr	53

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	35%				15%
Eff./COP	0.65				0.75

	Fossil		Elec. Res.
Fuel Share	50%		50%
Blended Efficiency	0.68		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load): 35.0

Wetting Use Percentage: 90%

All Electric EUI	
kWh/ft².yr	1.0
MJ/m².yr	38

Fossil Fuel EUI	
kWh/ft².yr	1.3
MJ/m².yr	51

Market Composite EUI	
kWh/ft².yr	1.2
MJ/m².yr	45.0

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EXISTING BUILDINGS: **Large Retail** **Baseline**

SIZE: **> 100,000 ft²**

VINTAGE:

REGION: **Vancouver Island**

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	5.0	L/s.m²	0.99	CFM/ft²
System Static Pressure CAV	500	Pa	2.0	wg
System Static Pressure VAV	750	Pa	3.0	wg
Fan Efficiency	60%			
Fan Motor Efficiency	80%			
Sizing Factor	1.00			
Fan Design Load CAV	5.2	W/m²	0.49	W/ft²
Fan Design Load VAV	7.9	W/m²	0.73	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	95%	5%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	50%	50%	100%	0%

Comments:

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.0	L/s.m²	0.00	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.1	L/s.m²	0.02	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.1	W/m²	0.01	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.024	kW/kW	0.08	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	2.11	W/m²	0.20	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.005	L/s.m²	0.007	U.S. gpm/ft²
Pump Head Pressure	0	kPa	0	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.00	W/m²	0.00	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.004	L/s.m²	0.0057	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	50	kPa	17	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.4	W/m²	0.04	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	32.2	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	1.3	kWh/m².yr
Condenser Pump Energy Consumption	0.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.8	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	1.9	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI		
	kWh/ft².yr	3.4
	MJ/m².yr	130.4

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Large Retail	**> 100,000 ft²**		**Vancouver Island**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES: **Electricity:** **23.4** kWh/ft².yr **905.1** MJ/m².yr **Fossil Fuel** **9.0** kWh/ft².yr **349.4** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	3.7	144.8
ARCHITECTURAL LIGHTING	9.0	349.0
SPECIAL PURPOSE LIGHTING	1.5	57.8
OTHER PLUG LOADS	0.8	30.6
HVAC FANS & PUMPS	3.4	130.4
REFRIGERATION	0.3	10.0
COMPUTER EQUIPMENT	1.2	45.8
ELEVATORS	0.3	11.6
OUTDOOR LIGHTING	0.9	33.9

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.5	19.4	8.0	308.6
SPACE COOLING	1.1	42.5	0.0	0.0
DOMESTIC HOT WATER	0.5	19.2	0.7	25.7
FOOD SERVICE EQUIPMENT	0.3	10.0	0.3	10.0
MISCELLANEOUS	0.0	0.0	0.1	5.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Medium Retail	**50,000 - 100,000 ft2**		**Vancouver Island**
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.73	W/m².°C	0.13	Btu/hr.ft² . °F	Typical Building Size	7,500	m²	80,700	ft²
Roof U value (W/m².°C)	0.60	W/m².°C	0.11	Btu/hr.ft² . °F	Typical Footprint (m²)	7,500	m²	80,700	ft²
Glazing U value (W/m².°C)	4.82	W/m².°C	0.85	Btu/hr.ft² . °F	Footprint Aspect Ratio (L:W)	5			
					Percent Conditioned Space	100%			
					Percent Conditioned Space Defined as Exterior Zone	29%			
Window/Wall Ratio (WIWAR) (%)	0.10								
Shading Coefficient (SC)	0.75				Typical # Stories	1			
					Floor to Floor Height (m)	5.0	m	16.5	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	100%		0%		0%		0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	25	m²/person	269	ft²/person	%OA	16.52%
Occupancy Schedule Occ. Period	90%					
Occupancy Schedule Unocc. Period	0%					
Fresh Air Requirements or Outside Air	20	L/s.person	42	CFM/person		

Fresh Air Control Type *(enter a 1, 2 or 3) | 1 | If Fresh Air Control Type = "2" enter % FA. to the right: | 34%
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air) | If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation | 0.5 L/s.m² | 0.10 CFM/ft²
50% operation (%)

Sizing Factor	1.5			
Total Air Circulation or Design Air Flow	4.84	L/s.m²	0.95	CFM/ft²
Infiltration Rate	0.42	L/s.m²	0.08	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based	Total
Incidence of Use	0%		100%	100%
Switchover Point		KJ/kg.	18 °C	
		Btu/lbm	64.4 °F	

Summary of Design Parameters		
Peak Design Cooling Load	2,348,396	
Peak Zone Sensible Load	1,102,783	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	51,301	
Total air circulation or Design air	4.84	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	21	°C	69.8	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	21	°C	69.8	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning — Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Retail	50,000 - 100,000 ft2		Vancouver Island
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	550	Lux	51.1	ft-candles
Floor Fraction (GLFF)	0.70			
Connected Load	15.7	W/m²	1.5	W/ft²

Occ. Period(Hrs./yr.)	4800
Unocc. Period(Hrs./yr.)	3960
Usage During Occupied Period	95%
Usage During Unoccupied Period	20%
Fixture Cleaning:	
Incidence of Practice	
Interval	years
Relamping Strategy & Incidence of Practice	Group / Spot

Light Level (Lux)	450	500	700	1000			Total
% Distribution	20%	50%	30%	0%			100%
Weighted Average							**550**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			55.0%		45.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	5.5
	MJ/m².yr	212

ARCHITECTURAL LIGHTING

Light Level	550	Lux	51.1	ft-candles
Floor Fraction (ALFF)	0.27			
Connected Load	60.8	W/m²	5.7	W/ft²

Occ. Period(Hrs./yr.)	4800
Unocc. Period(Hrs./yr.)	3960
Usage During Occupied Period	95%
Usage During Unoccupied Period	30%
Fixture Cleaning:	
Incidence of Practice	95%
Interval	20% years
Relamping Strategy & Incidence of Practice	Group / Spot

Light Level (Lux)	450	500	700	1000			Total
% Distribution	20%	50%	30%	0%			100%
Weighted Average							**550**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	65%	35%					0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	8.8
	MJ/m².yr	340

SPECIAL PURPOSE LIGHTING

Light Level	550.00	Lux	51.1	ft-candles
Floor Fraction (HBLFF)	0.03			
Connected Load	25.6	W/m²	2.4	W/ft²

Floor fraction check: should = 1.00 | 1.00

Occ. Period(Hrs./yr.)	4800
Unocc. Period(Hrs./yr.)	3960
Usage During Occupied Period	95%
Usage During Unoccupied Period	20%
Fixture Cleaning:	
Incidence of Practice	
Interval	years
Relamping Strategy & Incidence of Practice	Group / Spot

Light Level (Lux)	450	500	700	1000			Total
% Distribution	20%	50%	30%	0%			100%
Weighted Average							**550**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)						100%		100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	0.4
	MJ/m².yr	15

TOTAL LIGHTING

Overall LPD	27.44 W/m²	EUI TOTAL	kWh/ft².yr	14.6
	2.55 W/ft²		MJ/m².yr	567

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Servers	Plug Loads
Measured Power (W/device)	55	51	100	200	217	
Density (device/occupant)	0.36046	0.36046	0.01	0.01	0.02	
Connected Load	0.8 W/m²	0.7 W/m²	0.0 W/m²	0.1 W/m²	0.5 W/m²	1.15 W/m²
	0.1 W/ft²	0.1 W/ft²	0.00 W/ft²	0.01 W/ft²	0.05 W/ft²	0.11 W/ft²
Diversity Occupied Period	90%	90%	90%	90%	100%	90%
Diversity Unoccupied Period	50%	50%	50%	50%	100%	25%
Operation Occ. Period (hrs./year)	2000	2000	2600	2600	2600	4100
Operation Unocc. Period (hrs./year)	6760	6760	6160	6160	6160	4660

Total end-use load (occupied period)	3.0 W/m²	0.3 W/ft²
Total end-use load (unocc. period)	1.6 W/m²	0.2 W/ft²
Usage during occupied period	100%	
Usage during unoccupied period	54%	

	EUI		
Computer Equipment	EUI	kWh/ft².yr	1.21
		MJ/m².yr	46.85
Plug Loads	EUI	kWh/ft².yr	0.52
		MJ/m².yr	20.10

FOOD SERVICE EQUIPMENT

Provide description below:

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	0.5	EUI	kWh/ft².yr	0.5
	MJ/m².yr	20.0		MJ/m².yr	20.0

REFRIGERATION

Provide description below:

EUI	kWh/ft².yr	0.2
	MJ/m².yr	8.6

MISCELLANEOUS

Provide description below:

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	0.3	EUI	kWh/ft².yr	0.0
	MJ/m².yr	10.0		MJ/m².yr	0.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Retail	50,000 - 100,000 ft2		Vancouver Island
Baseline			

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	5%	2%	2%	55%	25%	0%	5%	1%	5%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff. (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	29.6	W/m²	9.4	Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	279	MJ/m².yr	7.2	kWh/ft².yr
Sizing Factor	1.00			
Electric Fuel Share	11.0%	Fossil Fuel Share	89.0%	

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	5.4
MJ/m².yr	210

Gas EUI	
kWh/ft².yr	9.4
MJ/m².yr	364

Market Composite EUI	
kWh/ft².yr	9.0
MJ/m².yr	347

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	10.0%	6.0%	0.0%	4.0%	80.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7	°C	44.6	°F
Condenser Water	30	°C	86	°F
Supply Air	14.0	°C	57.2	°F

Peak Cooling Load	92	W/m²	29	Btu/hr.ft²	412	ft²/Ton
Seasonal Cooling Load (Tertiary Load)	130.9	MJ/m².yr	3.4	kWh/ft².yr		

Sizing Factor: 1.00 — Operation (occ. period): 3000 hrs/year — Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C): 80.0%

Electric Fuel Share: 100.0% — Gas Fuel Share: 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenan

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	1.4
MJ/m².yr	53

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	1.4
MJ/m².yr	53

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	35%				10%
Eff./COP	0.65				0.75

	Fossil		Elec. Res.
Fuel Share	45%		55%
Blended Efficiency	0.67		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load): 35.0

Wetting Use Percentage: 90%

All Electric EUI	
kWh/ft².yr	1.0
MJ/m².yr	38

Fossil Fuel EUI	
kWh/ft².yr	1.3
MJ/m².yr	52

Market Composite EUI	
kWh/ft².yr	1.2
MJ/m².yr	44.6

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Retail	50,000 - 100,000 ft2		Vancouver Island
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	4.8	L/s.m²	0.95	CFM/ft²
System Static Pressure CAV	500	Pa	2.0	wg
System Static Pressure VAV	500	Pa	2.0	wg
Fan Efficiency	60%			
Fan Motor Efficiency	88%			
Sizing Factor	1.00			
Fan Design Load CAV	4.6	W/m²	0.43	W/ft²
Fan Design Load VAV	4.6	W/m²	0.43	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	100%	0%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	50%	50%	50%	50%
Comments:				

EXHAUST FANS

Washroom Exhaust	50	L/s.washroom	106	CFM/washroom
Washroom Exhaust per gross unit are	0.0	L/s.m²	0.00	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.1	L/s.m²	0.02	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.2	W/m²	0.01	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.020	kW/kW	0.07	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	1.83	W/m²	0.17	W/ft²

Condenser Pump

Pump Design Flow	0.000	L/s.KW	0.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.000	L/s.m²	0.000	U.S. gpm/ft²
Pump Head Pressure	45	kPa	15	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.00	W/m²	0.00	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.004	L/s.m²	0.0058	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	0	kPa	0	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.0	W/m²	0.00	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	28.1	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	0.9	kWh/m².yr
Condenser Pump Energy Consumption	0.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.7	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	0.0	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI		
	kWh/ft².yr	2.8
	MJ/m².yr	107.0

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Medium Retail	**50,000 - 100,000 ft2**		**Vancouver Island**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES: **Electricity:** **23.1** kWh/ft².yr **893.9** MJ/m².yr **Fossil Fue** **9.7** kWh/ft².yr **377.5** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	5.5	212.2
ARCHITECTURAL LIGHTING	8.8	339.9
SPECIAL PURPOSE LIGHTING	0.4	14.8
OTHER PLUG LOADS	0.5	20.1
HVAC FANS & PUMPS	2.8	107.0
REFRIGERATION	0.2	8.6
COMPUTER EQUIPMENT	1.2	46.9
ELEVATORS	0.1	3.9
OUTDOOR LIGHTING	0.9	33.9

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.6	23.1	8.4	324.1
SPACE COOLING	1.1	42.3	0.0	0.0
DOMESTIC HOT WATER	0.5	21.2	0.6	23.4
FOOD SERVICE EQUIPMENT	0.5	20.0	0.5	20.0
MISCELLANEOUS	0.0	0.0	0.3	10.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **SIZE:** **VINTAGE:** **REGION:**
Food Retail **Vancouver Island**
Baseline

CONSTRUCTION

Wall U value (W/m².°C)	0.73	W/m².°C	0.13	Btu/hr.ft² . °F
Roof U value (W/m².°C)	0.60	W/m².°C	0.11	Btu/hr.ft² . °F
Glazing U value (W/m².°C)	4.82	W/m².°C	0.85	Btu/hr.ft² . °F
Window/Wall Ratio (WIWAR) (%)	0.06			
Shading Coefficient (SC)	0.69			

Typical Building Size	4,000	m²	43,040	ft²
Typical Footprint (m²)	4,000	m²	43,040	ft²
Footprint Aspect Ratio (L:W)	1			
Percent Conditioned Space	100%			
Percent Conditioned Space Defined as Exterior Zone	40%			
Typical # Stories	1			
Floor to Floor Height (m)	4.6	m	15.0	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	100%		0%		0%		0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	45	m²/person	484	ft²/person
Occupancy Schedule Occ. Period	90%			
Occupancy Schedule Unocc. Period	0%			
Fresh Air Requirements or Outside Air	60	L/s.person	127	CFM/person

%OA 34.29%

Fresh Air Control Type *(enter a 1, 2 or 3) 1
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right: 0%
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation 0.5 L/s.m² 0.10 CFM/ft²
50% operation (%)

Sizing Factor	1.65			
Total Air Circulation or Design Air Flow	3.89	L/s.m²	0.77	CFM/ft²
Infiltration Rate	0.70	L/s.m²	0.14	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	1,495,736	
Peak Zone Sensible Load	429,325	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	19,972	
Total air circulation or Design air	3.89	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	22	°C	71.6	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	21	°C	69.8	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Food Retail			**Vancouver Island**
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	600	Lux	55.8	ft-candles
Floor Fraction (GLFF)	0.55			
Connected Load	16.7	W/m^2	1.6	W/ft^2
Occ. Period(Hrs./yr.)	4100			
Unocc. Period(Hrs./yr.)	4660			
Usage During Occupied Period	100%			
Usage During Unoccupied Period	40%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	500	600	700	800				Total
% Distribution	25%	50%	25%	0%				100%
Weighted Average								**600**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			40.0%		60.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI		
	kWh/ft^2.yr	5.1
	MJ/m^2.yr	197

ARCHITECTURAL LIGHTING

Light Level	640	Lux	59.5	ft-candles
Floor Fraction (ALFF)	0.05			
Connected Load	80.6	W/m^2	7.5	W/ft^2
Occ. Period(Hrs./yr.)	4100			
Unocc. Period(Hrs./yr.)	4660			
Usage During Occupied Period	100%			
Usage During Unoccupied Period	50%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	300	500	700	1000				Total
% Distribution	0%	30%	70%	0%				100%
Weighted Average								**640**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	80%	20%					0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI		
	kWh/ft^2.yr	2.4
	MJ/m^2.yr	93

EUI = Load X Hrs. X SF X GLFF

SPECIAL PURPOSE LIGHTING

Light Level	620.00	Lux	57.6	ft-candles
Floor Fraction (HBLFF)	0.40			
Connected Load	28.9	W/m^2	2.7	W/ft^2
Occ. Period(Hrs./yr.)	4100			
Unocc. Period(Hrs./yr.)	4660			
Usage During Occupied Period	100%			
Usage During Unoccupied Period	50%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 | 1.00

Light Level (Lux)	300	500	700	1000				Total
% Distribution	0%	40%	60%	0%				100%
Weighted Average								**620**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)						100%		100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI		
	kWh/ft^2.yr	6.9
	MJ/m^2.yr	268

TOTAL LIGHTING

Overall LPD	13.22 W/m^2	EUI TOTAL	kWh/ft^2.yr	14.4
	1.23 W/ft^2		MJ/m^2.yr	558

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Servers	Plug Loads
Measured Power (W/device)	55	51	100	200	217	
Density (device/occupant)	0.648828	0.648828	0.01	0.01	0.03	
Connected Load	0.8 W/m^2	0.7 W/m^2	0.0 W/m^2	0.0 W/m^2	0.5 W/m^2	2.85 W/m^2
	0.1 W/ft^2	0.1 W/ft^2	0.00 W/ft^2	0.00 W/ft^2	0.05 W/ft^2	0.26 W/ft^2
Diversity Occupied Period	90%	90%	90%	90%	100%	90%
Diversity Unoccupied Period	50%	50%	50%	50%	100%	50%
Operation Occ. Period (hrs./year)	2000	2000	2600	2600	2600	4100
Operation Unocc. Period (hrs./year)	6760	6760	6160	6160	6160	4660

Total end-use load (occupied period)	4.5 W/m^2	0.4 W/ft^2
Total end-use load (unocc. period)	2.7 W/m^2	0.3 W/ft^2
Usage during occupied period	100%	
Usage during unoccupied period	61%	

Computer Equipment	EUI	kWh/ft^2.yr	1.18
		MJ/m^2.yr	45.81
Plug Loads	EUI	kWh/ft^2.yr	1.59
		MJ/m^2.yr	61.77

FOOD SERVICE EQUIPMENT

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft^2.yr	2.1	EUI	kWh/ft^2.yr	1.5
	MJ/m^2.yr	80.0		MJ/m^2.yr	60.0

REFRIGERATION

Provide description below:

Commercial refrigeration display cases

EUI		
	kWh/ft^2.yr	31.0
	MJ/m^2.yr	1200.0

MISCELLANEOUS

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft^2.yr	0.5	EUI	kWh/ft^2.yr	1.5
	MJ/m^2.yr	20.0		MJ/m^2.yr	60.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **Food Retail** **Baseline**
SIZE:
VINTAGE:
REGION: **Vancouver Island**

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	5%	2%	2%	56%	25%	0%	5%		5%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff.) (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	24.6 W/m²	7.8 Btu/hr.ft²	
Seasonal Heating Load (Tertiary Load)	289 MJ/m².yr	7.5 kWh/ft².yr	
Sizing Factor	1.00		
Electric Fuel Share	10.0%	Fossil Fuel Share	90.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	5.9
MJ/m².yr	230

Gas EUI	
kWh/ft².yr	9.7
MJ/m².yr	377

Market Composite EUI	
kWh/ft².yr	9.3
MJ/m².yr	362

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	0.0%	0.0%	0.0%	10.0%	90.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7 °C	44.6 °F
Condenser Water	30 °C	86 °F
Supply Air	14.0 °C	57.2 °F

Peak Cooling Load	110 W/m²	35 Btu/hr.ft²	345 ft²/Ton
Seasonal Cooling Load (Tertiary Load)	127.4 MJ/m².yr	3.3 kWh/ft².yr	

Sizing Factor 1.00 — Operation (occ. period) 3000 hrs/year — Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C) 60.0%

Electric Fuel Share 100.0% — Gas Fuel Share 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	1.3
MJ/m².yr	51

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	1.3
MJ/m².yr	51

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	60%				5%
Eff./COP	0.65				0.75

	Fossil		Elec. Res.
Fuel Share	65%		35%
Blended Efficiency	0.66		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 70.0

Wetting Use Percentage 90%

All Electric EUI	
kWh/ft².yr	2.0
MJ/m².yr	77

Fossil Fuel EUI	
kWh/ft².yr	2.7
MJ/m².yr	106

Market Composite EUI	
kWh/ft².yr	2.5
MJ/m².yr	96.1

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **SIZE:** **VINTAGE:** **REGION:**
Food Retail **Vancouver Island**
Baseline

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	3.9	L/s.m²	0.77	CFM/ft²
System Static Pressure CAV	500	Pa	2.0	wg
System Static Pressure VAV	1000	Pa	4.0	wg
Fan Efficiency	60%			
Fan Motor Efficiency	80%			
Sizing Factor	1.00			
Fan Design Load CAV	4.1	W/m²	0.38	W/ft²
Fan Design Load VAV	8.1	W/m²	0.75	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	100%	0%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	60%	40%	100%	0%

Comments:

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m²	0.01	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.2	L/s.m²	0.03	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.2	W/m²	0.02	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.024	kW/kW	0.08	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	2.57	W/m²	0.24	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.006	L/s.m²	0.009	U.S. gpm/ft²
Pump Head Pressure	0	kPa	0	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.00	W/m²	0.00	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.005	L/s.m²	0.0070	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.9	W/m²	0.09	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	27.0	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	1.8	kWh/m².yr
Condenser Pump Energy Consumption	0.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.7	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	4.7	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI	kWh/ft².yr	3.2
	MJ/m².yr	123.0

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Food Retail			**Vancouver Island**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES: **Electricity:** **57.9** kWh/ft².yr **2,244.0** MJ/m².yr **Fossil Fue** **13.1** kWh/ft².yr **508.3** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	5.1	197.3
ARCHITECTURAL LIGHTING	2.4	93.3
SPECIAL PURPOSE LIGHTING	6.9	267.6
OTHER PLUG LOADS	1.6	61.8
HVAC FANS & PUMPS	3.2	123.0
REFRIGERATION	31.0	1,200.0
COMPUTER EQUIPMENT	1.2	45.8
ELEVATORS	0.1	3.9
OUTDOOR LIGHTING	1.3	50.9

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.6	23.0	8.8	339.2
SPACE COOLING	0.8	30.5	0.0	0.0
DOMESTIC HOT WATER	0.7	26.9	1.8	69.2
FOOD SERVICE EQUIPMENT	1.5	60.0	2.1	80.0
MISCELLANEOUS	1.5	60.0	0.5	20.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **SIZE:** **VINTAGE:** **REGION:**
Large Hotel **Vancouver Island**
Baseline

CONSTRUCTION

Wall U value (W/m².°C)	0.82	W/m².°C	0.14	Btu/hr.ft² . °F	Typical Building Size	20,000	m²	215,200	ft²
Roof U value (W/m².°C)	0.61	W/m².°C	0.11	Btu/hr.ft² . °F	Typical Footprint (m²)	2,000	m²	21,520	ft²
Glazing U value (W/m².°C)	4.30	W/m².°C	0.76	Btu/hr.ft² . °F	Footprint Aspect Ratio (L:W)	3			
					Percent Conditioned Space	100%			
					Percent Conditioned Space Defined as Exterior Zone	45%			
Window/Wall Ratio (WIWAR) (%)	0.30								
Shading Coefficient (SC)	0.65				Typical # Stories	10			
					Floor to Floor Height (m)	3.7	m	12.0	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	80%		0%		20%		0%		100%
Min. Air Flow (%)					60%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	50	m²/person	538	ft²/person	%OA 29.24%
Occupancy Schedule Occ. Period	50%				
Occupancy Schedule Unocc. Period	80%				
Fresh Air Requirements or Outside Air	80	L/s.person	170	CFM/person	

Fresh Air Control Type *(enter a 1, 2 or 3) (1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air): 1

If Fresh Air Control Type = "2" enter % FA. to the right: 15%
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation: 0.5 L/s.m² 0.10 CFM/ft²; 50% operation (%)

Sizing Factor	2.25			
Total Air Circulation or Design Air Flow	5.47	L/s.m²	1.08	CFM/ft²
Infiltration Rate	0.70	L/s.m²	0.14	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	8,542,376	
Peak Zone Sensible Load	2,215,308	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	103,056	
Total air circulation or Design air	5.47	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	23	°C	73.4	°F	15	°C	59	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	20.8	°C	69.44	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Hotel			Vancouver Island
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	290	Lux	27.0	ft-candles
Floor Fraction (GLFF)	0.25			
Connected Load	8.2	W/m²	0.8	W/ft²

Occ. Period(Hrs./yr.)	3000
Unocc. Period(Hrs./yr.)	5760
Usage During Occupied Period	85%
Usage During Unoccupied Period	90%

Light Level (Lux)	200	300	400	500	Total
% Distribution	50%	20%	20%	10%	100%
Weighted Average					**290**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			50.0%		50.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

Fixture Cleaning:
Incidence of Practice
Interval years

Relamping Strategy & Incidence of Practice: Group | Spot

EUI	kWh/ft².yr	1.5
	MJ/m².yr	57

ARCHITECTURAL LIGHTING

Light Level	220	Lux	20.4	ft-candles
Floor Fraction (ALFF)	0.75			
Connected Load	21.0	W/m²	1.9	W/ft²

Occ. Period(Hrs./yr.)	2500
Unocc. Period(Hrs./yr.)	6260
Usage During Occupied Period	60%
Usage During Unoccupied Period	40%

Light Level (Lux)	100	200	300	400	Total
% Distribution	20%	50%	20%	10%	100%
Weighted Average					**220**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	50%	50%					0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

Fixture Cleaning:
Incidence of Practice
Interval years

Relamping Strategy & Incidence of Practice: Group | Spot

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	5.8
	MJ/m².yr	227

SPECIAL PURPOSE LIGHTING

Light Level	0.00	Lux	0.0	ft-candles
Floor Fraction (HBLFF)	0.00			
Connected Load	0.0	W/m²	0.0	W/ft²

Floor fraction check: should = 1.00 | 1.00

Occ. Period(Hrs./yr.)	4000
Unocc. Period(Hrs./yr.)	4760
Usage During Occupied Period	0%
Usage During Unoccupied Period	100%

Light Level (Lux)	300	500	700	1000	Total
% Distribution		0%	0%	0%	0%
Weighted Average					**0**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)								0.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

Fixture Cleaning:
Incidence of Practice
Interval years

Relamping Strategy & Incidence of Practice: Group | Spot

EUI	kWh/ft².yr	0.0
	MJ/m².yr	0

TOTAL LIGHTING

Overall LPD	17.77 W/m²	EUI TOTAL	kWh/ft².yr	7.3
	1.65 W/ft²		MJ/m².yr	284

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Servers		Plug Loads	
Measured Power (W/device)	55		51		100		200		217			
Density (device/occupant)	0.3		0.3		0.05		0.033		0.03			
Connected Load	0.3	W/m²	0.3	W/m²	0.1	W/m²	0.1	W/m²	0.5	W/m²	2.1	W/m²
	0.0	W/ft²	0.0	W/ft²	0.01	W/ft²	0.01	W/ft²	0.05	W/ft²	0.20	W/ft²
Diversity Occupied Period	90%		90%		90%		90%		100%		70%	
Diversity Unoccupied Period	50%		50%		50%		50%		100%		25%	
Operation Occ. Period (hrs./year)	2500		2500		2500		2500		2500		3000	
Operation Unocc. Period (hrs./year)	6260		6260		6260		6260		6260		5760	

Total end-use load (occupied period)	2.8	W/m²	0.3	W/ft²
Total end-use load (unocc. period)	1.5	W/m²	0.1	W/ft²

Usage during occupied period	100%
Usage during unoccupied period	53%

Computer Equipment	EUI	kWh/ft².yr	0.85
		MJ/m².yr	32.93
Plug Loads	EUI	kWh/ft².yr	0.69
		MJ/m².yr	26.76

FOOD SERVICE EQUIPMENT

Provide description below:
Kitchen

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	2.6	EUI	kWh/ft².yr	0.5
	MJ/m².yr	100.0		MJ/m².yr	20.0

REFRIGERATION

Provide description below:
Walk-in coolers/freezers, reach-in coolers/freezers, refrigerated buffet cases

EUI	kWh/ft².yr	0.8
	MJ/m².yr	30.0

MISCELLANEOUS

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	1.5	EUI	kWh/ft².yr	0.0
	MJ/m².yr	60.0		MJ/m².yr	0.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **SIZE:** **VINTAGE:** **REGION:**
Large Hotel **Vancouver Island**
Baseline

SPACE HEATING

Heating Plant Type

							Electric			Other	
				Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	42%	20%	5%	18%	0%	0%	5%	2%	8%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff.) (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	27.6 W/m²	8.8 Btu/hr.ft²	
Seasonal Heating Load (Tertiary Load)	255 MJ/m².yr	6.6 kWh/ft².yr	
Sizing Factor	1.00		
Electric Fuel Share	15.0%	Fossil Fuel Share	85.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	5.1
MJ/m².yr	197

Gas EUI	
kWh/ft².yr	8.6
MJ/m².yr	332

Market Composite EUI	
kWh/ft².yr	8.0
MJ/m².yr	312

SPACE COOLING

A/C Plant Type

			WSHP			Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	45.0%	25.0%	0.0%	0.0%	30.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7 °C	44.6 °F
Condenser Water	30 °C	86 °F
Supply Air	15.0 °C	59 °F

Peak Cooling Load	113 W/m²	36 Btu/hr.ft²	336 ft²/Ton
Seasonal Cooling Load (Tertiary Load)	131.1 MJ/m².yr	3.4 kWh/ft².yr	

Sizing Factor 0.90 Operation (occ. period) 3000 hrs/year Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C) 80.0%

Electric Fuel Share 100.0% Gas Fuel Share 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	1.5
MJ/m².yr	56

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	1.5
MJ/m².yr	56

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	20%				70%
Eff./COP	0.65				0.75

	Fossil	Elec. Res.
Fuel Share	90%	10%
Blended Efficiency	0.73	0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 236.6

Wetting Use Percentage 90%

All Electric EUI	
kWh/ft².yr	6.7
MJ/m².yr	260

Fossil Fuel EUI	
kWh/ft².yr	8.4
MJ/m².yr	325

Market Composite EUI	
kWh/ft².yr	8.2
MJ/m².yr	318.6

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: Large Hotel Baseline | **SIZE:** | **VINTAGE:** | **REGION:** Vancouver Island

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	5.5	L/s.m²	1.08	CFM/ft²
System Static Pressure CAV	500	Pa	2.0	wg
System Static Pressure VAV	750	Pa	3.0	wg
Fan Efficiency	55%			
Fan Motor Efficiency	80%			
Sizing Factor	1.00			
Fan Design Load CAV	6.2	W/m²	0.58	W/ft²
Fan Design Load VAV	9.3	W/m²	0.87	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	80%	20%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	50%	50%	100%	0%

Comments:

EXHAUST FANS

Washroom Exhaust	550	L/s.washroom	1165	CFM/washroom
Washroom Exhaust per gross unit are	0.6	L/s.m²	0.11	CFM/ft²
Other Exhaust (Smoking/Conference)	0.5	L/s.m²	0.10	CFM/ft²
Total Building Exhaust	1.1	L/s.m²	0.21	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	50%			
Fan Motor Efficiency	80%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.7	W/m²	0.06	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.023	kW/kW	0.08	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	2.57	W/m²	0.24	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.006	L/s.m²	0.009	U.S. gpm/ft²
Pump Head Pressure	100	kPa	33.333333	ft
Pump Efficiency	55%			
Pump Motor Efficiency	85%			
Sizing Factor	1.0			
Pump Connected Load	1.28	W/m²	0.12	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.005	L/s.m²	0.0071	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	85%					
Sizing Factor	0.8					
Pump Connected Load	0.9	W/m²	0.08	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	38.6	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	5.7	kWh/m².yr
Condenser Pump Energy Consumption	2.7	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.8	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	4.6	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI	kWh/ft².yr	4.9
	MJ/m².yr	188.5

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Large Hotel			**Vancouver Island**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES: **Electricity:** **18.4** kWh/ft².yr **711.1** MJ/m².yr **Fossil Fuel** **19.0** kWh/ft².yr **734.7** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	1.5	57.2
ARCHITECTURAL LIGHTING	5.8	226.5
SPECIAL PURPOSE LIGHTING	0.0	0.0
OTHER PLUG LOADS	0.7	26.8
HVAC FANS & PUMPS	4.9	188.5
REFRIGERATION	0.8	30.0
COMPUTER EQUIPMENT	0.9	32.9
ELEVATORS	0.3	11.6
OUTDOOR LIGHTING	0.4	17.0

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.8	29.6	7.3	282.1
SPACE COOLING	1.2	44.9	0.0	0.0
DOMESTIC HOT WATER	0.7	26.0	7.6	292.6
FOOD SERVICE EQUIPMENT	0.5	20.0	2.6	100.0
MISCELLANEOUS	0.0	0.0	1.5	60.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **Medium Hotel** **Baseline**
SIZE: **50,000 to 100,000 ft²**
VINTAGE:
REGION: **Vancouver Island**

CONSTRUCTION

Wall U value (W/m².°C)	0.82	W/m².°C	0.14	Btu/hr.ft² . °F	Typical Building Size	6,000 m²	64,560	ft²
Roof U value (W/m².°C)	0.56	W/m².°C	0.10	Btu/hr.ft² . °F	Typical Footprint (m²)	1,500 m²	16,140	ft²
Glazing U value (W/m².°C)	4.30	W/m².°C	0.76	Btu/hr.ft² . °F	Footprint Aspect Ratio (L:W)	4		
					Percent Conditioned Space	100%		
					Percent Conditioned Space Defined as Exterior Zone	45%		
Window/Wall Ratio (WIWAR) (%)	0.28							
Shading Coefficient (SC)	0.57				Typical # Stories	4		
					Floor to Floor Height (m)	3.7 m	12.0	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	90%		0%		10%		0%		100%
Min. Air Flow (%)					60%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	46	m²/person	495	ft²/person
Occupancy Schedule Occ. Period	50%			
Occupancy Schedule Unocc. Period	80%			
Fresh Air Requirements or Outside Air	25	L/s.person	53	CFM/person

%OA 16.56%

Fresh Air Control Type *(enter a 1, 2 or 3) 1
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right: 15%
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation 0.5 L/s.m² 0.10 CFM/ft²
50% operation (%)

Sizing Factor	1.4			
Total Air Circulation or Design Air Flow	3.28	L/s.m²	0.65	CFM/ft²
Infiltration Rate	1.00	L/s.m²	0.20	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based	Total
Incidence of Use	0%		100%	100%
Switchover Point		KJ/kg.	18	°C
		Btu/lbm	64.4	°F

Summary of Design Parameters		
Peak Design Cooling Load	1,296,661	
Peak Zone Sensible Load	640,486	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	29,795	
Total air circulation or Design air	3.28	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	22	°C	71.6	°F	13	°C	55.4	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	21	°C	69.8	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Medium Hotel	**50,000 to 100,000 ft²**		**Vancouver Island**
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	125	Lux	11.6	ft-candles
Floor Fraction (GLFF)	0.20			
Connected Load	3.5	W/m²	0.3	W/ft²

Occ. Period(Hrs./yr.)	3400
Unocc. Period(Hrs./yr.)	5360
Usage During Occupied Period	95%
Usage During Unoccupied Period	40%
Fixture Cleaning:	
Incidence of Practice	
Interval	years
Relamping Strategy & Incidence of Practice	Group / Spot

Light Level (Lux)	125	300	700	1000				Total
% Distribution	100%	0%	0%	0%				100%
Weighted Average								**125**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			50.0%		50.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI		
	kWh/ft².yr	0.4
	MJ/m².yr	14

ARCHITECTURAL LIGHTING

Light Level	160	Lux	14.9	ft-candles
Floor Fraction (ALFF)	0.80			
Connected Load	16.9	W/m²	1.6	W/ft²

Occ. Period(Hrs./yr.)	2300
Unocc. Period(Hrs./yr.)	6460
Usage During Occupied Period	65%
Usage During Unoccupied Period	50%
Fixture Cleaning:	
Incidence of Practice	
Interval	years
Relamping Strategy & Incidence of Practice	Group / Spot

Light Level (Lux)	100	125	150	300				Total
% Distribution	20%	40%	20%	20%				100%
Weighted Average								**160**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	60%	40%					0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI		
	kWh/ft².yr	5.9
	MJ/m².yr	230

SPECIAL PURPOSE LIGHTING

Light Level	0.00	Lux	0.0	ft-candles
Floor Fraction (HBLFF)	0.00			
Connected Load	0.0	W/m²	0.0	W/ft²

Floor fraction check: should = 1.00 | 1.00

Occ. Period(Hrs./yr.)	4000
Unocc. Period(Hrs./yr.)	4760
Usage During Occupied Period	0%
Usage During Unoccupied Period	100%
Fixture Cleaning:	
Incidence of Practice	
Interval	years
Relamping Strategy & Incidence of Practice	Group / Spot

Light Level (Lux)	300	500	700	1000				Total
% Distribution		0%	0%	0%				0%
Weighted Average								**0**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)								0.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI		
	kWh/ft².yr	0.0
	MJ/m².yr	0

TOTAL LIGHTING

Overall LPD	14.21 W/m²	EUI TOTAL	kWh/ft².yr	6.3
	1.32 W/ft²		MJ/m².yr	243

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Servers	Plug Loads
Measured Power (W/device)	55	51	100	200	217	
Density (device/occupant)	0.3	0.3	0.05	0.033	0.02	
Connected Load	0.4 W/m²	0.3 W/m²	0.1 W/m²	0.1 W/m²	0.5 W/m²	2.05 W/m²
	0.0 W/ft²	0.0 W/ft²	0.01 W/ft²	0.01 W/ft²	0.05 W/ft²	0.19 W/ft²
Diversity Occupied Period	90%	90%	90%	90%	100%	70%
Diversity Unoccupied Period	50%	50%	50%	50%	100%	25%
Operation Occ. Period (hrs./year)	2500	2500	2500	2500	2500	3000
Operation Unocc. Period (hrs./year)	6260	6260	6260	6260	6260	5760

Total end-use load (occupied period)	2.8 W/m²	0.3 W/ft²
Total end-use load (unocc. period)	1.5 W/m²	0.1 W/ft²
Usage during occupied period	100%	
Usage during unoccupied period	54%	

Computer Equipment	EUI	kWh/ft².yr	0.89
		MJ/m².yr	34.38
Plug Loads	EUI	kWh/ft².yr	0.67
		MJ/m².yr	26.13

FOOD SERVICE EQUIPMENT

Provide description below:

Kitchen services

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	1.5	EUI	kWh/ft².yr	0.5
	MJ/m².yr	60.0		MJ/m².yr	20.0

REFRIGERATION

Provide description below:

Walk-in coolers/freezers, reach-in coolers/freezers, refrigerated buffet cases

EUI		
	kWh/ft².yr	0.8
	MJ/m².yr	30.0

MISCELLANEOUS

Provide description below:

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	1.5	EUI	kWh/ft².yr	0.0
	MJ/m².yr	60.0		MJ/m².yr	0.0

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Medium Hotel	**50,000 to 100,000 ft²**		**Vancouver Island**
Baseline			

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air							Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	District Heat	
System Present (%)	15%	10%	5%	30%	0%	0%	2%		38%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff. (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	39.0 W/m²	12.4 Btu/hr.ft²	
Seasonal Heating Load (Tertiary Load)	364 MJ/m².yr	9.4 kWh/ft².yr	
Sizing Factor	1.00		
Electric Fuel Share	40.0%	Fossil Fuel Share	60.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	9.2
MJ/m².yr	356

Gas EUI	
kWh/ft².yr	12.2
MJ/m².yr	473

Market Composite EUI	
kWh/ft².yr	11.0
MJ/m².yr	426

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	0.0%	0.0%	15.0%	15.0%	70.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7 °C	44.6 °F
Condenser Water	30 °C	86 °F
Supply Air	13.0 °C	55.4 °F

Peak Cooling Load	54 W/m²	17 Btu/hr.ft²	703 ft²/Ton
Seasonal Cooling Load (Tertiary Load)	94.3 MJ/m².yr	2.4 kWh/ft².yr	

Sizing Factor: 0.85 — Operation (occ. period): 3000 hrs/year — Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C): 50.0%

Electric Fuel Share: 100.0% — Gas Fuel Share: 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	1.0
MJ/m².yr	40

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	1.0
MJ/m².yr	40

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	40%				30%
Eff./COP	0.65				0.75

	Fossil		Elec. Res.
Fuel Share	70%		30%
Blended Efficiency	0.69		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load): 236.6

Wetting Use Percentage: 90%

All Electric EUI	
kWh/ft².yr	6.7
MJ/m².yr	260

Fossil Fuel EUI	
kWh/ft².yr	8.8
MJ/m².yr	341

Market Composite EUI	
kWh/ft².yr	8.2
MJ/m².yr	317.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: Medium Hotel Baseline | **SIZE:** 50,000 to 100,000 ft² | **VINTAGE:** | **REGION:** Vancouver Island

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	3.3	L/s.m²	0.65	CFM/ft²
System Static Pressure CAV	337.5	Pa	1.4	wg
System Static Pressure VAV	531.25	Pa	2.1	wg
Fan Efficiency	45%			
Fan Motor Efficiency	80%			
Sizing Factor	1.00			
Fan Design Load CAV	3.1	W/m²	0.29	W/ft²
Fan Design Load VAV	4.8	W/m²	0.45	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	90%	10%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	50%	50%	100%	0%
Comments:				

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m²	0.03	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.2	L/s.m²	0.05	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.3	W/m²	0.03	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.027	kW/kW	0.09	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	1.45	W/m²	0.14	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.003	L/s.m²	0.004	U.S. gpm/ft²
Pump Head Pressure	0	kPa	0	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.00	W/m²	0.00	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.002	L/s.m²	0.0034	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.5	W/m²	0.04	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	19.1	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	2.7	kWh/m².yr
Condenser Pump Energy Consumption	0.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.7	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	2.3	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI	kWh/ft².yr	2.3
	MJ/m².yr	89.2

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: Medium Hotel Baseline
SIZE: 50,000 to 100,000 ft²
VINTAGE:
REGION: Vancouver Island

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**18.0**	kWh/ft².yr	**695.4**	MJ/m².yr		
Fossil Fue		**16.6**	kWh/ft².yr	**643.0**	MJ/m².yr		

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	0.4	13.7
ARCHITECTURAL LIGHTING	5.9	229.7
SPECIAL PURPOSE LIGHTING	0.0	0.0
OTHER PLUG LOADS	0.7	26.1
HVAC FANS & PUMPS	2.3	89.2
REFRIGERATION	0.8	30.0
COMPUTER EQUIPMENT	0.9	34.4
ELEVATORS	0.3	11.6
OUTDOOR LIGHTING	0.0	0.0

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	3.7	142.5	7.3	284.0
SPACE COOLING	0.5	20.1	0.0	0.0
DOMESTIC HOT WATER	2.0	78.0	6.2	239.0
FOOD SERVICE EQUIPMENT	0.5	20.0	1.5	60.0
MISCELLANEOUS	0.0	0.0	1.5	60.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: Hospital Baseline | **SIZE:** | **VINTAGE:** | **REGION:** Vancouver Island

CONSTRUCTION

Wall U value (W/m².°C)	0.67 W/m².°C	0.12 Btu/hr.ft².°F		
Roof U value (W/m².°C)	0.58 W/m².°C	0.10 Btu/hr.ft².°F		
Glazing U value (W/m².°C)	4.30 W/m².°C	0.76 Btu/hr.ft².°F		
Window/Wall Ratio (WIWAR) (%)	0.15			
Shading Coefficient (SC)	0.65			

Typical Building Size	14,000 m²	150,640 ft²
Typical Footprint (m²)	1,750 m²	18,830 ft²
Footprint Aspect Ratio (L:W)	2	
Percent Conditioned Space	100%	
Percent Conditioned Space Defined as Exterior Zone	45%	
Typical # Stories	8	
Floor to Floor Height (m)	4.3 m	14.0 ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	50%		0%		50%		0%		100%
Min. Air Flow (%)					60%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	30 m²/person	323 ft²/person
Occupancy Schedule Occ. Period	90%	
Occupancy Schedule Unocc. Period	75%	
Fresh Air Requirements or Outside Air	75 L/s.person	159 CFM/person

%OA 45.11%

Fresh Air Control Type *(enter a 1, 2 or 3) 1
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right: 15%
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation 0.5 L/s.m² 0.10 CFM/ft²
50% operation (%)

Sizing Factor	2	
Total Air Circulation or Design Air Flow	5.54 L/s.m²	1.09 CFM/ft²
Infiltration Rate	0.70 L/s.m²	0.14 CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0 L/s.m²	0.00 CFM/ft²
Operation occupied period	50%	
Operation unoccupied period	50%	

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	8,738,539	
Peak Zone Sensible Load	1,766,990	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	82,200	
Total air circulation or Design air	5.54	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	24	°C	75.2	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	23	°C	73.4	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	23	°C	73.4	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Hospital			Vancouver Island
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	475	Lux	44.1	ft-candles
Floor Fraction (GLFF)	0.75			
Connected Load	13.1	W/m²	1.2	W/ft²
Occ. Period(Hrs./yr.)	3200			
Unocc. Period(Hrs./yr.)	5560			
Usage During Occupied Period	80%			
Usage During Unoccupied Period	35%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	100	250	700	800			Total
% Distribution		50%	50%	0%			100%
Weighted Average							**475**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			33.0%		67.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI kWh/ft².yr 4.1
MJ/m².yr 159

ARCHITECTURAL LIGHTING

Light Level	340	Lux	31.6	ft-candles
Floor Fraction (ALFF)	0.25			
Connected Load	32.4	W/m²	3.0	W/ft²
Occ. Period(Hrs./yr.)	2500			
Unocc. Period(Hrs./yr.)	6260			
Usage During Occupied Period	80%			
Usage During Unoccupied Period	35%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	100	250	700	800			Total
% Distribution		80%	20%	0%			100%
Weighted Average							**340**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	50%	50%						100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI kWh/ft².yr 3.2
MJ/m².yr 122

SPECIAL PURPOSE LIGHTING

Light Level	0.00	Lux	0.0	ft-candles
Floor Fraction (HBLFF)	0.00			
Connected Load	0.0	W/m²	0.0	W/ft²
Occ. Period(Hrs./yr.)	4000			
Unocc. Period(Hrs./yr.)	4760			
Usage During Occupied Period	0%			
Usage During Unoccupied Period	100%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 | 1.00

Light Level (Lux)	300	500	700	1000			Total
% Distribution		0%	0%	0%			0%
Weighted Average							**0**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)								0.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI kWh/ft².yr 0.0
MJ/m².yr 0

TOTAL LIGHTING

Overall LPD 17.89 W/m²
1.66 W/ft²

EUI TOTAL kWh/ft².yr 7.3
MJ/m².yr 281

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Servers		Plug Loads	
Measured Power (W/device)	55		51		100		200		217			
Density (device/occupant)	0.477744		0.477744		0.02		0.02		0.04			
Connected Load	0.9	W/m²	0.8	W/m²	0.1	W/m²	0.1	W/m²	0.5	W/m²	3.85	W/m²
	0.1	W/ft²	0.1	W/ft²	0.01	W/ft²	0.01	W/ft²	0.05	W/ft²	0.36	W/ft²
Diversity Occupied Period	90%		90%		90%		90%		100%		90%	
Diversity Unoccupied Period	50%		50%		50%		50%		100%		25%	
Operation Occ. Period (hrs./year)	2000		2000		2600		2600		2600		4100	
Operation Unocc. Period (hrs./year)	6760		6760		6160		6160		6160		4660	

Total end-use load (occupied period)	5.7	W/m²	0.5	W/ft²
Total end-use load (unocc. period)	2.4	W/m²	0.2	W/ft²
Usage during occupied period	100%			
Usage during unoccupied period	43%			

Computer Equipment EUI kWh/ft².yr 1.33
MJ/m².yr 51.37

Plug Loads EUI kWh/ft².yr 1.74
MJ/m².yr 67.29

FOOD SERVICE EQUIPMENT

Provide description below:

Commercial food services

	Gas EUI		Electric EUI	
EUI	kWh/ft².yr	1.8	kWh/ft².yr	1.3
	MJ/m².yr	70.0	MJ/m².yr	50.0

REFRIGERATION

Provide description below:

Walk-in coolers/freezers, reach-in coolers/freezers, refrigerated buffet cases

EUI kWh/ft².yr 0.4
MJ/m².yr 15.0

MISCELLANEOUS

Provide description below:

	Gas EUI		Electric EUI	
EUI	kWh/ft².yr	6.5	kWh/ft².yr	0.0
	MJ/m².yr	250.0	MJ/m².yr	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Hospital			**Vancouver Island**
Baseline			

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	10%	75%	0%	10%	0%	0%	1%	0%	4%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff. (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	18.0 W/m²	5.7 Btu/hr.ft²	
Seasonal Heating Load (Tertiary Load)	683 MJ/m².yr	17.6 kWh/ft².yr	
Sizing Factor	1.00		
Electric Fuel Share	5.0%	Fossil Fuel Share	95.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	16.2
MJ/m².yr	627
Gas EUI	
kWh/ft².yr	22.4
MJ/m².yr	866
Market Composite EUI	
kWh/ft².yr	22.0
MJ/m².yr	854

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	60.0%	20.0%	0.0%	15.0%	5.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7 °C	44.6 °F
Condenser Water	30 °C	86 °F
Supply Air	14.0 °C	57.2 °F

Peak Cooling Load	183 W/m²	58 Btu/hr.ft²	207 ft²/Ton
Seasonal Cooling Load (Tertiary Load)	148.2 MJ/m².yr	3.8 kWh/ft².yr	

Sizing Factor 1.00 — Operation (occ. period) 3000 hrs/year — Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C) 85.0%

Electric Fuel Share 100.0% — Gas Fuel Share 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	2.3
MJ/m².yr	89
Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0
Market Composite EUI	
kWh/ft².yr	2.3
MJ/m².yr	89

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	10%				80%
Eff./COP	0.65				0.80

	Fossil	Elec. Res.
Fuel Share	90%	10%
Blended Efficiency	0.78	0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 250.0

Wetting Use Percentage 90%

All Electric EUI		Fossil Fuel EUI		Market Composite EUI	
kWh/ft².yr	7.1	kWh/ft².yr	8.2	kWh/ft².yr	8.1
MJ/m².yr	275	MJ/m².yr	319	MJ/m².yr	314.7

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Hospital			Vancouver Island
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	5.5	L/s.m²	1.09	CFM/ft²
System Static Pressure CAV	875	Pa	3.5	wg
System Static Pressure VAV	838	Pa	3.4	wg
Fan Efficiency	52%			
Fan Motor Efficiency	85%			
Sizing Factor	1.00			
Fan Design Load CAV	11.0	W/m²	1.02	W/ft²
Fan Design Load VAV	10.5	W/m²	0.98	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	50%	50%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	80%	20%	100%	0%

Comments:

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m²	0.02	CFM/ft²
Other Exhaust (Smoking/Conference)	0.5	L/s.m²	0.10	CFM/ft²
Total Building Exhaust	0.6	L/s.m²	0.12	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.8	W/m²	0.08	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.020	kW/kW	0.07	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	3.66	W/m²	0.34	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.010	L/s.m²	0.014	U.S. gpm/ft²
Pump Head Pressure	100	kPa	33.333333	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	2.42	W/m²	0.23	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.008	L/s.m²	0.0116	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	1.6	W/m²	0.15	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	70.8	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	7.2	kWh/m².yr
Condenser Pump Energy Consumption	5.9	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.8	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	7.9	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI		
	kWh/ft².yr	8.6
	MJ/m².yr	332.9

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **SIZE:** **VINTAGE:** **REGION:**

Hospital **Vancouver Island**

Baseline

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**25.2** kWh/ft².yr	**977.4** MJ/m².yr	**Fossil Fue**	**36.9** kWh/ft².yr	**1,429.9** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	4.1	158.9
ARCHITECTURAL LIGHTING	3.2	122.1
SPECIAL PURPOSE LIGHTING	0.0	0.0
OTHER PLUG LOADS	1.7	67.3
HVAC FANS & PUMPS	8.6	332.9
REFRIGERATION	0.4	15.0
COMPUTER EQUIPMENT	1.3	51.4
ELEVATORS	0.3	11.6
OUTDOOR LIGHTING	0.9	33.9

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.8	31.3	21.2	822.7
SPACE COOLING	1.9	75.5	0.0	0.0
DOMESTIC HOT WATER	0.7	27.5	7.4	287.2
FOOD SERVICE EQUIPMENT	1.3	50.0	1.8	70.0
MISCELLANEOUS	0.0	0.0	6.5	250.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Nursing Home	50,000 to 100,000 ft^2		Vancouver Island
Baseline			

CONSTRUCTION

Wall U value (W/m^2.°C)	0.67	W/m^2.°C	0.12	Btu/hr.ft^2 . °F	Typical Building Size	5,600	m^2	60,256 ft^2
Roof U value (W/m^2.°C)	0.56	W/m^2.°C	0.10	Btu/hr.ft^2 . °F	Typical Footprint (m^2)	2,800	m^2	30,128 ft^2
Glazing U value (W/m^2.°C)	4.57	W/m^2.°C	0.80	Btu/hr.ft^2 . °F	Footprint Aspect Ratio (L:W)	7		
					Percent Conditioned Space	100%		
					Percent Conditioned Space Defined as Exterior Zone	45%		
Window/Wall Ratio (WIWAR) (%)	0.28							
Shading Coefficient (SC)	0.60				Typical # Stories	2		
					Floor to Floor Height (m)	3.7	m	12.0 ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	90%		0%		10%	0%	0%		100%
Min. Air Flow (%)					60%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	30	m^2/person	323	ft^2/person
Occupancy Schedule Occ. Period	100%			
Occupancy Schedule Unocc. Period	95%			
Fresh Air Requirements or Outside Air	38	L/s.person	81	CFM/person

%OA 36.98%

Fresh Air Control Type *(enter a 1, 2 or 3) 1
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right:	15%		
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation	0.5 L/s.m^2	0.10	CFM/ft^2
	50% operation (%)		

Sizing Factor	1.3			
Total Air Circulation or Design Air Flow	3.42	L/s.m^2	0.67	CFM/ft^2
Infiltration Rate	0.30	L/s.m^2	0.06	CFM/ft^2

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0	L/s.m^2	0.00	CFM/ft^2
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	2,110,762	
Peak Zone Sensible Load	671,967	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft^3/lbm
Design CFM	31,260	
Total air circulation or Design air	3.42	l/s.m^2

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	23	°C	73.4	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	23	°C	73.4	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	23	°C	73.4	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning — Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Nursing Home	50,000 to 100,000 ft^2		Vancouver Island
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	267	Lux	24.8	ft-candles
Floor Fraction (GLFF)	0.70			
Connected Load	7.3	W/m^2	0.7	W/ft^2

Occ. Period(Hrs./yr.)	3400
Unocc. Period(Hrs./yr.)	5360
Usage During Occupied Period	95%
Usage During Unoccupied Period	20%

Light Level (Lux)	200	300	500	1000	Total
% Distribution	33%	67%	0%	0%	100%
Weighted Average					**267**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			33.0%		67.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

Fixture Cleaning:
Incidence of Practice
Interval years

Relamping Strategy & Incidence of Practice	Group	Spot

EUI	kWh/ft^2.yr	2.1
	MJ/m^2.yr	80

ARCHITECTURAL LIGHTING

Light Level	233	Lux	21.7	ft-candles
Floor Fraction (ALFF)	0.30			
Connected Load	24.6	W/m^2	2.3	W/ft^2

Occ. Period(Hrs./yr.)	3400
Unocc. Period(Hrs./yr.)	5360
Usage During Occupied Period	95%
Usage During Unoccupied Period	30%

Light Level (Lux)	200	300	400	500	Total
% Distribution	67%	33%	0%	0%	100%
Weighted Average					**233**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	60%	40%					0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

Fixture Cleaning:
Incidence of Practice
Interval years

Relamping Strategy & Incidence of Practice	Group	Spot

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft^2.yr	3.3
	MJ/m^2.yr	128

SPECIAL PURPOSE LIGHTING

Light Level	0.00	Lux	0.0	ft-candles
Floor Fraction (HBLFF)	0.00			
Connected Load	0.0	W/m^2	0.0	W/ft^2

Floor fraction check: should = 1.00 | 1.00

Occ. Period(Hrs./yr.)	4000
Unocc. Period(Hrs./yr.)	4760
Usage During Occupied Period	0%
Usage During Unoccupied Period	100%

Light Level (Lux)	300	500	700	1000	Total
% Distribution		0%	0%	0%	0%
Weighted Average					**0**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)								0.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

Fixture Cleaning:
Incidence of Practice
Interval years

Relamping Strategy & Incidence of Practice	Group	Spot

EUI	kWh/ft^2.yr	0.0
	MJ/m^2.yr	0

TOTAL LIGHTING

Overall LPD	12.51 W/m^2	EUI TOTAL	kWh/ft^2.yr	5.4
	1.16 W/ft^2		MJ/m^2.yr	208

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Servers	Plug Loads
Measured Power (W/device)	55	51	100	200	217	
Density (device/occupant)	0.477744	0.477744	0.02	0.02	0.04	
Connected Load	0.9 W/m^2	0.8 W/m^2	0.1 W/m^2	0.1 W/m^2	0.5 W/m^2	1.35 W/m^2
	0.1 W/ft^2	0.1 W/ft^2	0.01 W/ft^2	0.01 W/ft^2	0.05 W/ft^2	0.13 W/ft^2
Diversity Occupied Period	90%	90%	90%	90%	100%	90%
Diversity Unoccupied Period	50%	50%	50%	50%	100%	25%
Operation Occ. Period (hrs./year)	2000	2000	2600	2600	2600	4100
Operation Unocc. Period (hrs./year)	6760	6760	6160	6160	6160	4660

Total end-use load (occupied period)	3.4 W/m^2	0.3 W/ft^2
Total end-use load (unocc. period)	1.8 W/m^2	0.2 W/ft^2
Usage during occupied period	100%	
Usage during unoccupied period	52%	

Computer Equipment	EUI	kWh/ft^2.yr	1.33
		MJ/m^2.yr	51.37
Plug Loads	EUI	kWh/ft^2.yr	0.61
		MJ/m^2.yr	23.60

FOOD SERVICE EQUIPMENT

Provide description below:

	Gas EUI			Electric EUI	
EUI	kWh/ft^2.yr	1.5	EUI	kWh/ft^2.yr	1.3
	MJ/m^2.yr	60.0		MJ/m^2.yr	50.0

REFRIGERATION

Provide description below:

Walk-in coolers/freezers, reach-in coolers/freezers, refrigerated buffet cases

EUI	kWh/ft^2.yr	0.8
	MJ/m^2.yr	30.0

MISCELLANEOUS

Provide description below:

	Gas EUI			Electric EUI	
EUI	kWh/ft^2.yr	1.8	EUI	kWh/ft^2.yr	0.0
	MJ/m^2.yr	70.0		MJ/m^2.yr	

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Nursing Home	50,000 to 100,000 ft²		Vancouver Island
Baseline			

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	35%	35%	5%	10%	5%	0%	5%	0%	5%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff. (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	29.2	W/m²	9.3	Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	330	MJ/m².yr	8.5	kWh/ft².yr
Sizing Factor	1.00			
Electric Fuel Share	10.0%	Fossil Fuel Share	90.0%	

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	6.8
MJ/m².yr	262

Gas EUI	
kWh/ft².yr	11.0
MJ/m².yr	424

Market Composite EUI	
kWh/ft².yr	10.5
MJ/m².yr	408

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	0.0%	0.0%	0.0%	15.0%	85.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7	°C	44.6	°F
Condenser Water	30	°C	86	°F
Supply Air	14.0	°C	57.2	°F

Peak Cooling Load	94	W/m²	30	Btu/hr.ft²	403	ft²/Ton
Seasonal Cooling Load (Tertiary Load)	107.1	MJ/m².yr	2.8	kWh/ft².yr		

Sizing Factor 0.85 — Operation (occ. period) 3000 hrs/year — Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C) 30.0%

Electric Fuel Share 100.0% — Gas Fuel Share 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	1.2
MJ/m².yr	48

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	1.2
MJ/m².yr	48

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	10%				60%
Eff./COP	0.65				0.75

	Fossil		Elec. Res.
Fuel Share	70%		30%
Blended Efficiency	0.74		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 175.0

Wetting Use Percentage 90%

All Electric EUI	
kWh/ft².yr	5.0
MJ/m².yr	192

Fossil Fuel EUI	
kWh/ft².yr	6.1
MJ/m².yr	238

Market Composite EUI	
kWh/ft².yr	5.8
MJ/m².yr	224.2

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Nursing Home	50,000 to 100,000 ft²		Vancouver Island
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	3.4	L/s.m²	0.67	CFM/ft²
System Static Pressure CAV	500	Pa	2.0	wg
System Static Pressure VAV	500	Pa	2.0	wg
Fan Efficiency	52%			
Fan Motor Efficiency	75%			
Sizing Factor	1.00			
Fan Design Load CAV	4.4	W/m²	0.41	W/ft²
Fan Design Load VAV	4.4	W/m²	0.41	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	90%	10%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	80%	20%	100%	0%
Comments:				

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m²	0.01	CFM/ft²
Other Exhaust (Smoking/Conference)	0.5	L/s.m²	0.10	CFM/ft²
Total Building Exhaust	0.6	L/s.m²	0.11	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.8	W/m²	0.07	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.020	kW/kW	0.07	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	1.88	W/m²	0.17	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.005	L/s.m²	0.007	U.S. gpm/ft²
Pump Head Pressure	0	kPa	0	ft
Pump Efficiency	55%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.00	W/m²	0.00	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.004	L/s.m²	0.0060	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	55%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.7	W/m²	0.07	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	32.8	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	6.7	kWh/m².yr
Condenser Pump Energy Consumption	0.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.6	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	3.7	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI		
	kWh/ft².yr	4.1
	MJ/m².yr	157.6

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Nursing Home	50,000 to 100,000 ft²		Vancouver Island
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:				
Electricity:	17.2 kWh/ft².yr	664.3 MJ/m².yr		
Fossil Fuel	17.5 kWh/ft².yr	678.4 MJ/m².yr		

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	2.1	79.6
ARCHITECTURAL LIGHTING	3.3	128.4
SPECIAL PURPOSE LIGHTING	0.0	0.0
OTHER PLUG LOADS	0.6	23.6
HVAC FANS & PUMPS	4.1	157.6
REFRIGERATION	0.8	30.0
COMPUTER EQUIPMENT	1.3	51.4
ELEVATORS	0.3	11.6
OUTDOOR LIGHTING	0.9	33.9

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.7	26.2	9.9	381.9
SPACE COOLING	0.4	14.3	0.0	0.0
DOMESTIC HOT WATER	1.5	57.7	4.3	166.5
FOOD SERVICE EQUIPMENT	1.3	50.0	1.5	60.0
MISCELLANEOUS	0.0	0.0	1.8	70.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Large Schools	**> 50,000 ft2**		**Vancouver Island**
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.64	W/m².°C	0.11	Btu/hr.ft² . °F	Typical Building Size	9,300	m²	100,068	ft²
Roof U value (W/m².°C)	0.61	W/m².°C	0.11	Btu/hr.ft² . °F	Typical Footprint (m²)	4,650	m²	50,034	ft²
Glazing U value (W/m².°C)	4.57	W/m².°C	0.80	Btu/hr.ft² . °F	Footprint Aspect Ratio (L:W)	5			
					Percent Conditioned Space	100%			
					Percent Conditioned Space Defined as Exterior Zone	37%			
Window/Wall Ratio (WIWAR) (%)	0.13								
Shading Coefficient (SC)	0.65				Typical # Stories	2			
					Floor to Floor Height (m)	4.0	m	13.2	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	90%		0%		10%		0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	10	m²/person	108	ft²/person	%OA	28.92%
Occupancy Schedule Occ. Period	90%					
Occupancy Schedule Unocc. Period	0%					
Fresh Air Requirements or Outside Air	9	L/s.person	19	CFM/person		

Fresh Air Control Type *(enter a 1, 2 or 3) | 1
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right: 34%
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation: 0.5 L/s.m² | 0.10 CFM/ft² | 50% operation (%)

Sizing Factor	1.5			
Total Air Circulation or Design Air Flow	3.11	L/s.m²	0.61	CFM/ft²
Infiltration Rate	0.42	L/s.m²	0.08	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	2,733,944	
Peak Zone Sensible Load	878,925	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	40,888	
Total air circulation or Design air	3.11	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	23	°C	73.4	°F	13	°C	55.4	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	20.4	°C	68.72	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning — Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Schools	> 50,000 ft2		Vancouver Island
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	440	Lux	40.9	ft-candles
Floor Fraction (GLFF)	0.89			
Connected Load	12.1	W/m²	1.1	W/ft²
Occ. Period(Hrs./yr.)	3000			
Unocc. Period(Hrs./yr.)	5760			
Usage During Occupied Period	85%			
Usage During Unoccupied Period	25%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	300	500	700	1000				Total
% Distribution	40%	50%	10%	0%				100%
Weighted Average								**440**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			35.0%		65.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	4.0
	MJ/m².yr	155

ARCHITECTURAL LIGHTING

Light Level	400	Lux	37.2	ft-candles
Floor Fraction (ALFF)	0.01			
Connected Load	27.8	W/m²	2.6	W/ft²
Occ. Period(Hrs./yr.)	3000			
Unocc. Period(Hrs./yr.)	5760			
Usage During Occupied Period	90%			
Usage During Unoccupied Period	75%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	300	500	700	1000				Total
% Distribution	50%	50%	0%	0%				100%
Weighted Average								**400**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	25%	75%						100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI	kWh/ft².yr	0.2
	MJ/m².yr	7

EUI = Load X Hrs. X SF X GLFF

SPECIAL PURPOSE LIGHTING

Light Level	300.00	Lux	27.9	ft-candles
Floor Fraction (HBLFF)	0.10			
Connected Load	14.0	W/m²	1.3	W/ft²
Occ. Period(Hrs./yr.)	3000			
Unocc. Period(Hrs./yr.)	5760			
Usage During Occupied Period	100%			
Usage During Unoccupied Period	25%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 | 1.00

Light Level (Lux)	300	500	700	1000				Total
% Distribution	100%	0%	0%	0%				100%
Weighted Average								**300**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)						100%		100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	0.6
	MJ/m².yr	22

TOTAL LIGHTING

Overall LPD	12.48 W/m²	EUI TOTAL	kWh/ft².yr	4.8
	1.16 W/ft²		MJ/m².yr	185

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Servers	Plug Loads
Measured Power (W/device)	55	51	100	200	217	
Density (device/occupant)	0.222732	0.222732	0.02	0.02	0.01	
Connected Load	1.2 W/m²	1.1 W/m²	0.2 W/m²	0.4 W/m²	0.5 W/m²	0.25 W/m²
	0.1 W/ft²	0.1 W/ft²	0.02 W/ft²	0.04 W/ft²	0.05 W/ft²	0.02 W/ft²
Diversity Occupied Period	90%	90%	90%	90%	100%	100%
Diversity Unoccupied Period	25%	25%	25%	25%	100%	0%
Operation Occ. Period (hrs./year)	2000	2000	2000	2000	2600	3000
Operation Unocc. Period (hrs./year)	6760	6760	6760	6760	6160	5760

Total end-use load (occupied period)	3.4 W/m²	0.3 W/ft²
Total end-use load (unocc. period)	1.3 W/m²	0.1 W/ft²
Usage during occupied period	100%	
Usage during unoccupied period	37%	

Computer Equipment	EUI	kWh/ft².yr	1.37
		MJ/m².yr	53.21
Plug Loads	EUI	kWh/ft².yr	0.07
		MJ/m².yr	2.70

FOOD SERVICE EQUIPMENT

Provide description below:

Cafeteria

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	0.5	EUI	kWh/ft².yr	0.1
	MJ/m².yr	20.0		MJ/m².yr	5.0

REFRIGERATION

Provide description below:

EUI	kWh/ft².yr	0.1
	MJ/m².yr	2.1

MISCELLANEOUS

Provide description below:

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	0.1	EUI	kWh/ft².yr	0.0
	MJ/m².yr	5.0		MJ/m².yr	0.0

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Large Schools	**> 50,000 ft2**		**Vancouver Island**
Baseline			

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	45%	20%	7%	10%	12%	0%	3%	0%	3%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff. (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	23.5 W/m²	7.5 Btu/hr.ft²	
Seasonal Heating Load (Tertiary Load)	229 MJ/m².yr	5.9 kWh/ft².yr	
Sizing Factor	1.00		
Electric Fuel Share	6.0%	Fossil Fuel Share	94.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	4.7
MJ/m².yr	181

Gas EUI	
kWh/ft².yr	7.6
MJ/m².yr	294

Market Composite EUI	
kWh/ft².yr	7.4
MJ/m².yr	288

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	0.0%	0.0%	0.0%	15.0%	85.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7 °C	44.6 °F
Condenser Water	30 °C	86 °F
Supply Air	13.0 °C	55.4 °F

Peak Cooling Load	86 W/m²	27 Btu/hr.ft²	439 ft²/Ton
Seasonal Cooling Load (Tertiary Load)	87.5 MJ/m².yr	2.3 kWh/ft².yr	

Sizing Factor 1.00 — Operation (occ. period) 3000 hrs/year — Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C) 10.0%

Electric Fuel Share 100.0% — Gas Fuel Share 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenan

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	1.0
MJ/m².yr	37

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	1.0
MJ/m².yr	37

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	45%				25%
Eff./COP	0.65				0.75

	Fossil	Elec. Res.
Fuel Share	70%	30%
Blended Efficiency	0.69	0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 40.0

Wetting Use Percentage 90%

All Electric EUI	
kWh/ft².yr	1.1
MJ/m².yr	44

Fossil Fuel EUI	
kWh/ft².yr	1.5
MJ/m².yr	58

Market Composite EUI	
kWh/ft².yr	1.4
MJ/m².yr	54.0

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Large Schools	**> 50,000 ft2**		**Vancouver Island**
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	3.1	L/s.m²	0.61	CFM/ft²
System Static Pressure CAV	500	Pa	2.0	wg
System Static Pressure VAV	500	Pa	2.0	wg
Fan Efficiency	60%			
Fan Motor Efficiency	88%			
Sizing Factor	1.00			
Fan Design Load CAV	2.9	W/m²	0.27	W/ft²
Fan Design Load VAV	2.9	W/m²	0.27	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	90%	10%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	40%	60%	50%	50%
Comments:				

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.0	L/s.m²	0.01	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.1	L/s.m²	0.03	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.2	W/m²	0.02	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.020	kW/kW	0.07	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	1.72	W/m²	0.16	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.005	L/s.m²	0.007	U.S. gpm/ft²
Pump Head Pressure	0	kPa	0	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.00	W/m²	0.00	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.004	L/s.m²	0.0055	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.7	W/m²	0.07	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	15.9	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	1.2	kWh/m².yr
Condenser Pump Energy Consumption	0.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.5	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	3.7	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI	kWh/ft².yr	2.0
	MJ/m².yr	76.5

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Large Schools	**> 50,000 ft2**		**Vancouver Island**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**9.6** kWh/ft².yr	**372.7** MJ/m².yr	**Fossil Fuel**	**8.8** kWh/ft².yr	**342.6** MJ/m².yr	

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	4.0	155.2
ARCHITECTURAL LIGHTING	0.2	7.0
SPECIAL PURPOSE LIGHTING	0.6	22.4
OTHER PLUG LOADS	0.1	2.7
HVAC FANS & PUMPS	2.0	76.5
REFRIGERATION	0.1	2.1
COMPUTER EQUIPMENT	1.4	53.2
ELEVATORS	0.1	3.9
OUTDOOR LIGHTING	0.4	17.0

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.3	10.9	7.1	276.8
SPACE COOLING	0.1	3.7	0.0	0.0
DOMESTIC HOT WATER	0.3	13.2	1.1	40.8
FOOD SERVICE EQUIPMENT	0.1	5.0	0.5	20.0
MISCELLANEOUS	0.0	0.0	0.1	5.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Schools	< 50,000 ft2		Vancouver Island
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.64	W/m².°C	0.11	Btu/hr.ft² . °F	Typical Building Size	2,300	m²	24,748	ft²
Roof U value (W/m².°C)	0.61	W/m².°C	0.11	Btu/hr.ft² . °F	Typical Footprint (m²)	2,300	m²	24,748	ft²
Glazing U value (W/m².°C)	4.57	W/m².°C	0.80	Btu/hr.ft² . °F	Footprint Aspect Ratio (L:W)	5			
					Percent Conditioned Space	100%			
					Percent Conditioned Space Defined as Exterior Zone	50%			
Window/Wall Ratio (WIWAR) (%)	0.13								
Shading Coefficient (SC)	0.65				Typical # Stories	1			
					Floor to Floor Height (m)	4.0	m	13.2	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	100%		0%		0%		0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	10	m²/person	108	ft²/person
Occupancy Schedule Occ. Period	90%			
Occupancy Schedule Unocc. Period	0%			
Fresh Air Requirements or Outside Air	8	L/s.person	16	CFM/person

%OA 23.43%

Fresh Air Control Type *(enter a 1, 2 or 3) 1
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right: 34%
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation 0.5 L/s.m² 0.10 CFM/ft²
50% operation (%)

Sizing Factor	1.3			
Total Air Circulation or Design Air Flow	3.20	L/s.m²	0.63	CFM/ft²
Infiltration Rate	0.42	L/s.m²	0.08	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	649,039	
Peak Zone Sensible Load	257,935	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	11,999	
Total air circulation or Design air	3.20	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	21	°C	69.8	°F	13	°C	55.4	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	20.4	°C	68.72	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Schools	< 50,000 ft2		Vancouver Island
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	400	Lux	37.2	ft-candles
Floor Fraction (GLFF)	0.89			
Connected Load	11.0	W/m²	1.0	W/ft²
Occ. Period(Hrs./yr.)	2400			
Unocc. Period(Hrs./yr.)	6360			
Usage During Occupied Period	85%			
Usage During Unoccupied Period	25%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	300	500	700	1000				Total
% Distribution	50%	50%	0%	0%				100%
Weighted Average								**400**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			35.0%		65.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	3.3
	MJ/m².yr	128

ARCHITECTURAL LIGHTING

Light Level	400	Lux	37.2	ft-candles
Floor Fraction (ALFF)	0.01			
Connected Load	27.8	W/m²	2.6	W/ft²
Occ. Period(Hrs./yr.)	2400			
Unocc. Period(Hrs./yr.)	6360			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	30%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	300	500	700	1000				Total
% Distribution	50%	50%	0%	0%				100%
Weighted Average								**400**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	25%	75%						100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	0.1
	MJ/m².yr	4

SPECIAL PURPOSE LIGHTING

Light Level	300.00	Lux	27.9	ft-candles
Floor Fraction (HBLFF)	0.10			
Connected Load	14.0	W/m²	1.3	W/ft²
Occ. Period(Hrs./yr.)	4000			
Unocc. Period(Hrs./yr.)	4760			
Usage During Occupied Period	100%			
Usage During Unoccupied Period	10%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 | 1.00

Light Level (Lux)	300	500	700	1000				Total
% Distribution	100%	0%	0%	0%				100%
Weighted Average								**300**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)						100%		100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	0.6
	MJ/m².yr	23

TOTAL LIGHTING

Overall LPD	10.10 W/m²	EUI TOTAL	kWh/ft².yr	4.0
	0.94 W/ft²		MJ/m².yr	155

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Servers		Plug Loads	
Measured Power (W/device)	55		51		100		200		217			
Density (device/occupant)	0.05		0.05		0.02		0.02		0.01			
Connected Load	0.3	W/m²	0.3	W/m²	0.2	W/m²	0.4	W/m²	0.5	W/m²	0.2	W/m²
	0.0	W/ft²	0.0	W/ft²	0.02	W/ft²	0.04	W/ft²	0.05	W/ft²	0.02	W/ft²
Diversity Occupied Period	90%		90%		90%		90%		100%		100%	
Diversity Unoccupied Period	25%		25%		25%		25%		100%		0%	
Operation Occ. Period (hrs./year)	2900		2900		2600		2600		2600		3000	
Operation Unocc. Period (hrs./year)	5860		5860		6160		6160		6160		5760	

Total end-use load (occupied period)	1.7	W/m²	0.2	W/ft²
Total end-use load (unocc. period)	0.8	W/m²	0.1	W/ft²
Usage during occupied period	100%			
Usage during unoccupied period	46%			

Computer Equipment	EUI	kWh/ft².yr	0.83
		MJ/m².yr	32.30
Plug Loads	EUI	kWh/ft².yr	0.06
		MJ/m².yr	2.16

FOOD SERVICE EQUIPMENT

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	0.3	EUI	kWh/ft².yr	0.2
	MJ/m².yr	10.0		MJ/m².yr	8.0

REFRIGERATION

Provide description below:

EUI	kWh/ft².yr	0.0
	MJ/m².yr	1.1

MISCELLANEOUS

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	0.1	EUI	kWh/ft².yr	1.2
	MJ/m².yr	5.0		MJ/m².yr	45.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Schools	< 50,000 ft2		Vancouver Island
Baseline			

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	45%	20%	7%	10%	12%	0%	3%	0%	3%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff. (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	32.1	W/m²	10.2	Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	311	MJ/m².yr	8.0	kWh/ft².yr
Sizing Factor	1.00			
Electric Fuel Share	6.0%	Fossil Fuel Share	94.0%	

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	6.4
MJ/m².yr	247

Gas EUI	
kWh/ft².yr	10.3
MJ/m².yr	401

Market Composite EUI	
kWh/ft².yr	10.1
MJ/m².yr	391

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7	°C	44.6	°F
Condenser Water	30	°C	86	°F
Supply Air	13.0	°C	55.4	°F

Peak Cooling Load	83	W/m²	26	Btu/hr.ft²	458	ft²/Ton
Seasonal Cooling Load (Tertiary Load)	83.1	MJ/m².yr	2.1	kWh/ft².yr		

Sizing Factor 1.00 Operation (occ. period) 3000 hrs/year Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C) 10.0%

Electric Fuel Share 100.0% Gas Fuel Share 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	0.9
MJ/m².yr	36

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	0.9
MJ/m².yr	36

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	45%				25%
Eff./COP	0.65				0.75

	Fossil		Elec. Res.
Fuel Share	70%		30%
Blended Efficiency	0.69		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 40.0

Wetting Use Percentage 90%

All Electric EUI	
kWh/ft².yr	1.1
MJ/m².yr	44

Fossil Fuel EUI	
kWh/ft².yr	1.5
MJ/m².yr	58

Market Composite EUI	
kWh/ft².yr	1.4
MJ/m².yr	54.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Schools	< 50,000 ft2		Vancouver Island
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	3.2	L/s.m²	0.63	CFM/ft²
System Static Pressure CAV	250	Pa	1.0	wg
System Static Pressure VAV	250	Pa	1.0	wg
Fan Efficiency	60%			
Fan Motor Efficiency	88%			
Sizing Factor	1.00			
Fan Design Load CAV	1.5	W/m²	0.14	W/ft²
Fan Design Load VAV	1.5	W/m²	0.14	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	65%	35%	50%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	65%	35%	50%	50%
Comments:				

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m²	0.02	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.2	L/s.m²	0.04	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.2	W/m²	0.02	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.020	kW/kW	0.07	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	1.65	W/m²	0.15	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.004	L/s.m²	0.006	U.S. gpm/ft²
Pump Head Pressure	0	kPa	0	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.00	W/m²	0.00	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.004	L/s.m²	0.0052	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.7	W/m²	0.07	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	9.1	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	1.5	kWh/m².yr
Condenser Pump Energy Consumption	0.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.4	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	3.6	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI		
	kWh/ft².yr	1.4
	MJ/m².yr	52.8

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Medium Schools	**< 50,000 ft2**		**Vancouver Island**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:				
Electricity:	**9.0** kWh/ft².yr	**347.0** MJ/m².yr		
Fossil Fue	**11.2** kWh/ft².yr	**432.4** MJ/m².yr		

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	3.3	128.4
ARCHITECTURAL LIGHTING	0.1	4.2
SPECIAL PURPOSE LIGHTING	0.6	22.5
OTHER PLUG LOADS	0.1	2.2
HVAC FANS & PUMPS	1.4	52.8
REFRIGERATION	0.0	1.1
COMPUTER EQUIPMENT	0.8	32.3
ELEVATORS	0.1	1.9
OUTDOOR LIGHTING	0.4	17.0

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.4	14.8	9.7	376.6
SPACE COOLING	0.1	3.6	0.0	0.0
DOMESTIC HOT WATER	0.3	13.2	1.1	40.8
FOOD SERVICE EQUIPMENT	0.2	8.0	0.3	10.0
MISCELLANEOUS	1.2	45.0	0.1	5.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **SIZE:** **VINTAGE:** **REGION:**
University-Colleges **Vancouver Island**
Baseline

CONSTRUCTION

Wall U value (W/m².°C)	0.75	W/m².°C	0.13	Btu/hr.ft² . °F
Roof U value (W/m².°C)	0.61	W/m².°C	0.11	Btu/hr.ft² . °F
Glazing U value (W/m².°C)	4.56	W/m².°C	0.80	Btu/hr.ft² . °F
Window/Wall Ratio (WIWAR) (%)	0.30			
Shading Coefficient (SC)	0.65			

Typical Building Size	9,000	m²	96,840	ft²
Typical Footprint (m²)	3,000	m²	32,280	ft²
Footprint Aspect Ratio (L:W)	7			
Percent Conditioned Space	100%			
Percent Conditioned Space Defined as Exterior Zone	50%			
Typical # Stories	3			
Floor to Floor Height (m)	3.7	m	12.0	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	70%		0%		30%		0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	14	m²/person	151	ft²/person
Occupancy Schedule Occ. Period	90%			
Occupancy Schedule Unocc. Period	0%			
Fresh Air Requirements or Outside Air	15	L/s.person	32	CFM/person

%OA 20.96%

Fresh Air Control Type *(enter a 1, 2 or 3) 1
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right: 34%
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation 0.5 L/s.m² 0.10 CFM/ft²
50% operation (%)

Sizing Factor	1.6			
Total Air Circulation or Design Air Flow	5.11	L/s.m²	1.01	CFM/ft²
Infiltration Rate	0.70	L/s.m²	0.14	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	3,348,143	
Peak Zone Sensible Load	1,309,381	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	60,912	
Total air circulation or Design air	5.11	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	24	°C	75.2	°F	13	°C	55.4	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	16	°C	60.8	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	20.4	°C	68.72	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **SIZE:** **VINTAGE:** **REGION:**
University-Colleges **Vancouver Island**
Baseline

LIGHTING

GENERAL LIGHTING

Light Level	610	Lux	56.7	ft-candles
Floor Fraction (GLFF)	0.93			
Connected Load	16.8	W/m²	1.6	W/ft²
Occ. Period(Hrs./yr.)	4100			
Unocc. Period(Hrs./yr.)	4660			
Usage During Occupied Period	90%			
Usage During Unoccupied Period	20%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	300	500	700	1000	Total
% Distribution	10%	25%	65%	0%	100%
Weighted Average					**610**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			35.0%	0%	65.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI kWh/ft².yr 6.7
MJ/m².yr 260

ARCHITECTURAL LIGHTING

Light Level	300	Lux	27.9	ft-candles
Floor Fraction (ALFF)	0.03			
Connected Load	28.6	W/m²	2.7	W/ft²
Occ. Period(Hrs./yr.)	4100			
Unocc. Period(Hrs./yr.)	4660			
Usage During Occupied Period	100%			
Usage During Unoccupied Period	50%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	300	500	700	1000	Total
% Distribution	100%	0%	0%	0%	100%
Weighted Average					**300**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	50%	50%					0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI kWh/ft².yr 0.5
MJ/m².yr 20

SPECIAL PURPOSE LIGHTING

Light Level	640.00	Lux	59.5	ft-candles
Floor Fraction (HBLFF)	0.04			
Connected Load	29.8	W/m²	2.8	W/ft²
Occ. Period(Hrs./yr.)	4100			
Unocc. Period(Hrs./yr.)	4660			
Usage During Occupied Period	90%			
Usage During Unoccupied Period	20%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 | 1.00

Light Level (Lux)	300	500	700	1000	Total
% Distribution	0%	30%	70%	0%	100%
Weighted Average					**640**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)						100%		100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI kWh/ft².yr 0.5
MJ/m².yr 20

TOTAL LIGHTING Overall LPD 16.51 W/m² 1.53 W/ft²

EUI TOTAL kWh/ft².yr 7.7
MJ/m².yr 300

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Servers	Plug Loads
Measured Power (W/device)	55	51	100	200	217	
Density (device/occupant)	0.311825	0.311825	0.02	0.02	0.01	
Connected Load	1.2 W/m²	1.1 W/m²	0.1 W/m²	0.3 W/m²	0.5 W/m²	1.3 W/m²
	0.1 W/ft²	0.1 W/ft²	0.01 W/ft²	0.03 W/ft²	0.05 W/ft²	0.12 W/ft²
Diversity Occupied Period	90%	90%	90%	90%	100%	100%
Diversity Unoccupied Period	50%	50%	50%	50%	100%	20%
Operation Occ. Period (hrs./year)	2000	2000	2600	2600	2600	2000
Operation Unocc. Period (hrs./year)	6760	6760	6160	6160	6160	6760

Total end-use load (occupied period)	4.3 W/m²	0.4 W/ft²
Total end-use load (unocc. period)	2.2 W/m²	0.2 W/ft²
Usage during occupied period	100%	
Usage during unoccupied period	50%	

Computer Equipment	EUI	kWh/ft².yr	1.76
		MJ/m².yr	68.30
Plug Loads	EUI	kWh/ft².yr	0.40
		MJ/m².yr	15.69

FOOD SERVICE EQUIPMENT

Provide description below:

	Gas EUI			Electric EUI		
EUI	kWh/ft².yr	1.0	EUI	kWh/ft².yr	0.3
	MJ/m².yr	40.0		MJ/m².yr	10.0

REFRIGERATION

Provide description below:

EUI kWh/ft².yr 0.5
MJ/m².yr 20.0

MISCELLANEOUS

Provide description below:

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	1.8	EUI	kWh/ft².yr	0.0
	MJ/m².yr	70.0		MJ/m².yr	0.0

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **SIZE:** **VINTAGE:** **REGION:**
University-Colleges **Vancouver Island**
Baseline

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	20%	60%	5%	10%	0%	0%	2%	0%	3%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff. (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	34.0 W/m²	10.8 Btu/hr.ft²	
Seasonal Heating Load (Tertiary Load)	308 MJ/m².yr	7.9 kWh/ft².yr	
Sizing Factor	1.00		
Electric Fuel Share	5.0%	Fossil Fuel Share	95.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	6.6
MJ/m².yr	257

Gas EUI	
kWh/ft².yr	10.1
MJ/m².yr	390

Market Composite EUI	
kWh/ft².yr	9.9
MJ/m².yr	384

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	20.0%	5.0%	0.0%	0.0%	75.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7 °C	44.6 °F
Condenser Water	30 °C	86 °F
Supply Air	13.0 °C	55.4 °F

Peak Cooling Load	109 W/m²	35 Btu/hr.ft²	347 ft²/Ton
Seasonal Cooling Load (Tertiary Load)	146.2 MJ/m².yr	3.8 kWh/ft².yr	

Sizing Factor 1.00 Operation (occ. period) 3000 hrs/year Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C) 10.0%

Electric Fuel Share 100.0% Gas Fuel Share 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	1.6
MJ/m².yr	63

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	1.6
MJ/m².yr	63

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	10%				75%
Eff./COP	0.65				0.75

	Fossil	Elec. Res.
Fuel Share	85%	15%
Blended Efficiency	0.74	0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 65.0

Wetting Use Percentage 90%

All Electric EUI	
kWh/ft².yr	1.8
MJ/m².yr	71

Fossil Fuel EUI	
kWh/ft².yr	2.3
MJ/m².yr	88

Market Composite EUI	
kWh/ft².yr	2.2
MJ/m².yr	85.6

EXISTING BUILDINGS: University-Colleges Baseline | **SIZE:** | **VINTAGE:** | **REGION:** Vancouver Island

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	5.1	L/s.m²	1.01	CFM/ft²
System Static Pressure CAV	1000	Pa	4.0	wg
System Static Pressure VAV	1000	Pa	4.0	wg
Fan Efficiency	60%			
Fan Motor Efficiency	80%			
Sizing Factor	1.00			
Fan Design Load CAV	10.6	W/m²	0.99	W/ft²
Fan Design Load VAV	10.6	W/m²	0.99	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	70%	30%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	50%	50%	100%	0%

Comments:

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m²	0.01	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.2	L/s.m²	0.03	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.2	W/m²	0.02	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.027	kW/kW	0.09	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	2.94	W/m²	0.27	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.006	L/s.m²	0.009	U.S. gpm/ft²
Pump Head Pressure	0	kPa	0	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.00	W/m²	0.00	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.005	L/s.m²	0.0069	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.9	W/m²	0.09	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	58.1	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	1.9	kWh/m².yr
Condenser Pump Energy Consumption	0.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	1.1	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	4.7	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI		
	kWh/ft².yr	6.1
	MJ/m².yr	237.0

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: University-Colleges Baseline | **SIZE:** | **VINTAGE:** | **REGION:** Vancouver Island

EUI SUMMARY

TOTAL ALL END-USES: **Electricity:** **18.3** kWh/ft².yr **709.6** MJ/m².yr **Fossil Fuel** **14.3** kWh/ft².yr **555.7** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	6.7	260.5
ARCHITECTURAL LIGHTING	0.5	19.8
SPECIAL PURPOSE LIGHTING	0.5	19.9
OTHER PLUG LOADS	0.4	15.7
HVAC FANS & PUMPS	6.1	237.0
REFRIGERATION	0.5	20.0
COMPUTER EQUIPMENT	1.8	68.3
ELEVATORS	0.3	11.6
OUTDOOR LIGHTING	0.4	17.0

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.3	12.8	9.6	370.8
SPACE COOLING	0.2	6.3	0.0	0.0
DOMESTIC HOT WATER	0.3	10.7	1.9	74.8
FOOD SERVICE EQUIPMENT	0.3	10.0	1.0	40.0
MISCELLANEOUS	0.0	0.0	1.8	70.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: Restaurant Baseline | **SIZE:** | **VINTAGE:** | **REGION:** Vancouver Island

CONSTRUCTION

Wall U value (W/m².°C)	0.59	W/m².°C	0.10	Btu/hr.ft² . °F
Roof U value (W/m².°C)	0.53	W/m².°C	0.09	Btu/hr.ft² . °F
Glazing U value (W/m².°C)	4.43	W/m².°C	0.78	Btu/hr.ft² . °F
Window/Wall Ratio (WIWAR) (%)	0.18			
Shading Coefficient (SC)	0.69			

Typical Building Size	1,225	m²	13,181	ft²
Typical Footprint (m²)	1,225	m²	13,181	ft²
Footprint Aspect Ratio (L:W)	1			
Percent Conditioned Space	100%			
Percent Conditioned Space Defined as Exterior Zone	40%			
Typical # Stories	1			
Floor to Floor Height (m)	4.6	m	15.0	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	100%		0%		0%		0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	20	m²/person	215	ft²/person
Occupancy Schedule Occ. Period	90%			
Occupancy Schedule Unocc. Period	0%			
Fresh Air Requirements or Outside Air	33	L/s.person	70	CFM/person

%OA 30.92%

Fresh Air Control Type *(enter a 1, 2 or 3) 1
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right: 0%
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation: 0.5 L/s.m² | 0.10 CFM/ft² | 50% operation (%)

Sizing Factor	1.4			
Total Air Circulation or Design Air Flow	5.34	L/s.m²	1.05	CFM/ft²
Infiltration Rate	0.70	L/s.m²	0.14	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	623,113	
Peak Zone Sensible Load	212,634	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	9,892	
Total air circulation or Design air	5.34	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	22	°C	71.6	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	21	°C	69.8	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning — Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Restaurant			Vancouver Island
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	400	Lux	37.1	ft-candles
Floor Fraction (GLFF)	0.20			
Connected Load	11.7	W/m²	1.1	W/ft²
Occ. Period(Hrs./yr.)	3400			
Unocc. Period(Hrs./yr.)	5360			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	20%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	300	400	500	1000	Total
% Distribution	33%	33%	33%	0%	100%
Weighted Average					**399.6**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			66.0%	0%	34.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	0.9
	MJ/m².yr	36

ARCHITECTURAL LIGHTING

Light Level	250	Lux	23.2	ft-candles
Floor Fraction (ALFF)	0.80			
Connected Load	32.8	W/m²	3.0	W/ft²
Occ. Period(Hrs./yr.)	3400			
Unocc. Period(Hrs./yr.)	5360			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	30%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	100	200	300	400	Total
% Distribution	10%	40%	40%	10%	100%
Weighted Average					**250**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	85%	15%					0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	11.8
	MJ/m².yr	457

SPECIAL PURPOSE LIGHTING

Light Level	0.00	Lux	0.0	ft-candles
Floor Fraction (HBLFF)	0.00			
Connected Load	0.0	W/m²	0.0	W/ft²
Occ. Period(Hrs./yr.)	4000			
Unocc. Period(Hrs./yr.)	4760			
Usage During Occupied Period	0%			
Usage During Unoccupied Period	100%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 | 1.00

Light Level (Lux)	300	500	700	1000	Total
% Distribution		0%	0%	0%	0%
Weighted Average					**0**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)								0.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	0.0
	MJ/m².yr	0

TOTAL LIGHTING

Overall LPD	28.56 W/m²	EUI TOTAL	kWh/ft².yr	12.7
	2.65 W/ft²		MJ/m².yr	493

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Servers	Plug Loads
Measured Power (W/device)	55	51	100	200	217	
Density (device/occupant)	0.1614	0.1614	0.01	0.01	0.01	
Connected Load	0.4 W/m²	0.4 W/m²	0.1 W/m²	0.1 W/m²	0.5 W/m²	3.2 W/m²
	0.0 W/ft²	0.0 W/ft²	0.00 W/ft²	0.01 W/ft²	0.05 W/ft²	0.30 W/ft²
Diversity Occupied Period	90%	90%	90%	90%	100%	90%
Diversity Unoccupied Period	50%	50%	50%	50%	100%	90%
Operation Occ. Period (hrs./year)	2000	2000	2600	2600	2600	4100
Operation Unocc. Period (hrs./year)	6760	6760	6160	6160	6160	4660

Total end-use load (occupied period)	4.3 W/m²	0.4 W/ft²
Total end-use load (unocc. period)	3.9 W/m²	0.4 W/ft²
Usage during occupied period	100%	
Usage during unoccupied period	91%	

Computer Equipment	EUI	kWh/ft².yr	0.90
		MJ/m².yr	34.97
Plug Loads	EUI	kWh/ft².yr	2.34
		MJ/m².yr	90.82

FOOD SERVICE EQUIPMENT

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	23.2	EUI	kWh/ft².yr	8.5
	MJ/m².yr	900.0		MJ/m².yr	330.0

REFRIGERATION

Provide description below:

EUI	kWh/ft².yr	16.8
	MJ/m².yr	650.0

MISCELLANEOUS

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	0.5	EUI	kWh/ft².yr	0.0
	MJ/m².yr	20.0		MJ/m².yr	0.0

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **SIZE:** **VINTAGE:** **REGION:**
Restaurant **Vancouver Island**
Baseline

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	2%	1%	1%	48%	35%	0%	1%	2%	10%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff. (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	32.2 W/m²	10.2 Btu/hr.ft²	
Seasonal Heating Load (Tertiary Load)	318 MJ/m².yr	8.2 kWh/ft².yr	
Sizing Factor	1.00		
Electric Fuel Share	13.0%	Fossil Fuel Share	87.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	kWh/ft².yr	7.1
	MJ/m².yr	275
Gas EUI	kWh/ft².yr	10.6
	MJ/m².yr	412
Market Composite EUI	kWh/ft².yr	10.2
	MJ/m².yr	395

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	0.0%	0.0%	0.0%	10.0%	90.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7 °C	44.6 °F
Condenser Water	30 °C	86 °F
Supply Air	14.0 °C	57.2 °F

Peak Cooling Load	179 W/m²	57 Btu/hr.ft²	212 ft²/Ton
Seasonal Cooling Load (Tertiary Load)	178.3 MJ/m².yr	4.6 kWh/ft².yr	

Sizing Factor 1.20 Operation (occ. period) 3000 hrs/year Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C) 70.0%

Electric Fuel Share 100.0% Gas Fuel Share 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenan

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	kWh/ft².yr	2.1
	MJ/m².yr	81
Natural Gas EUI	kWh/ft².yr	0.0
	MJ/m².yr	0
Market Composite EUI	kWh/ft².yr	2.1
	MJ/m².yr	81

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	30%				30%
Eff./COP	0.65				0.75

	Fossil		Elec. Res.
Fuel Share	60%		40%
Blended Efficiency	0.70		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 600.0

Wetting Use Percentage 10%

	All Electric EUI	Fossil Fuel EUI	Market Composite EUI
kWh/ft².yr	17.0	22.1	20.1
MJ/m².yr	659	857	778.0

EXISTING BUILDINGS: **SIZE:** **VINTAGE:** **REGION:**
Restaurant **Vancouver Island**
Baseline

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	5.3	L/s.m²	1.05	CFM/ft²
System Static Pressure CAV	500	Pa	2.0	wg
System Static Pressure VAV	500	Pa	2.0	wg
Fan Efficiency	60%			
Fan Motor Efficiency	80%			
Sizing Factor	1.00			
Fan Design Load CAV	5.6	W/m²	0.52	W/ft²
Fan Design Load VAV	5.6	W/m²	0.52	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	100%	0%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	80%	20%	100%	0%
Comments:				

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.2	L/s.m²	0.03	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.3	L/s.m²	0.05	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.4	W/m²	0.03	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.020	kW/kW	0.07	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	3.58	W/m²	0.33	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.009	L/s.m²	0.014	U.S. gpm/ft²
Pump Head Pressure	0	kPa	0	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.00	W/m²	0.00	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.008	L/s.m²	0.0113	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	0	kPa	0	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.0	W/m²	0.00	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	42.8	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	3.1	kWh/m².yr
Condenser Pump Energy Consumption	0.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	1.0	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	0.0	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI		
	kWh/ft².yr	4.4
	MJ/m².yr	168.8

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Restaurant			Vancouver Island
Baseline			

EUI SUMMARY

TOTAL ALL END-USES: **Electricity:** **58.6** kWh/ft².yr **2,271.5** MJ/m².yr **Fossil Fuel** **46.3** kWh/ft².yr **1,793.1** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	0.9	36.1
ARCHITECTURAL LIGHTING	11.8	456.8
SPECIAL PURPOSE LIGHTING	0.0	0.0
OTHER PLUG LOADS	2.3	90.8
HVAC FANS & PUMPS	4.4	168.8
REFRIGERATION	16.8	650.0
COMPUTER EQUIPMENT	0.9	35.0
ELEVATORS	0.1	1.9
OUTDOOR LIGHTING	3.8	145.9

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.9	35.8	9.3	358.8
SPACE COOLING	1.5	56.7	0.0	0.0
DOMESTIC HOT WATER	6.8	263.7	13.3	514.3
FOOD SERVICE EQUIPMENT	8.5	330.0	23.2	900.0
MISCELLANEOUS	0.0	0.0	0.5	20.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: Warehouse/Whsale Baseline | **SIZE:** 0 | **VINTAGE:** | **REGION:** Vancouver Island

CONSTRUCTION

Wall U value (W/m².°C)	0.65	W/m².°C	0.11	Btu/hr.ft² . °F
Roof U value (W/m².°C)	0.54	W/m².°C	0.09	Btu/hr.ft² . °F
Glazing U value (W/m².°C)	4.10	W/m².°C	0.72	Btu/hr.ft² . °F
Window/Wall Ratio (WIWAR) (%)	0.05			
Shading Coefficient (SC)	0.80			

Typical Building Size	3,200	m²	34,432	ft²
Typical Footprint (m²)	3,200	m²	34,432	ft²
Footprint Aspect Ratio (L:W)	1			
Percent Conditioned Space	100%			
Percent Conditioned Space Defined as Exterior Zone	40%			
Typical # Stories	1			
Floor to Floor Height (m)	6.1	m	19.9	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	100%		0%		0%		0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	100	m²/person	1076	ft²/person
Occupancy Schedule Occ. Period	90%			
Occupancy Schedule Unocc. Period	0%			
Fresh Air Requirements or Outside Air	35	L/s.person	74	CFM/person

%OA 14.21%

Fresh Air Control Type *(enter a 1, 2 or 3) 1
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right: 0%
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation 0.5 L/s.m² 0.10 CFM/ft²
50% operation (%)

Sizing Factor	1.6			
Total Air Circulation or Design Air Flow	2.46	L/s.m²	0.49	CFM/ft²
Infiltration Rate	0.70	L/s.m²	0.14	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based	Total
Incidence of Use	0%		100%	100%
Switchover Point		KJ/kg.	18 °C	
		Btu/lbm	64.4 °F	

Summary of Design Parameters		
Peak Design Cooling Load	451,435	
Peak Zone Sensible Load	224,429	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	10,440	
Total air circulation or Design air	2.46	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	22	°C	71.6	°F	13	°C	55.4	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	16	°C	60.8	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	20.25	°C	68.45	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning — Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Warehouse/Whsale	0		Vancouver Island
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	500	Lux	46.5	ft-candles
Floor Fraction (GLFF)	0.33			
Connected Load	14.6	W/m²	1.4	W/ft²
Occ. Period(Hrs./yr.)	3500			
Unocc. Period(Hrs./yr.)	5260			
Usage During Occupied Period	100%			
Usage During Unoccupied Period	25%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	300	500	700	1000	Total
% Distribution	0%	100%	0%	0%	100%
Weighted Average					**500**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			65.0%	0%	35.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	2.1
	MJ/m².yr	83

ARCHITECTURAL LIGHTING

Light Level	500	Lux	46.5	ft-candles
Floor Fraction (ALFF)	0.02			
Connected Load	55.3	W/m²	5.1	W/ft²
Occ. Period(Hrs./yr.)	2500			
Unocc. Period(Hrs./yr.)	6260			
Usage During Occupied Period	100%			
Usage During Unoccupied Period	50%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	300	500	700	1000	Total
% Distribution	0%	100%	0%	0%	100%
Weighted Average					**500**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	65%	35%					0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	0.6
	MJ/m².yr	22

SPECIAL PURPOSE LIGHTING

Light Level	420.00	Lux	39.0	ft-candles
Floor Fraction (HBLFF)	0.65			
Connected Load	16.3	W/m²	1.5	W/ft²
Occ. Period(Hrs./yr.)	3500			
Unocc. Period(Hrs./yr.)	5260			
Usage During Occupied Period	100%			
Usage During Unoccupied Period	25%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 | 1.00

Light Level (Lux)	300	500	700	1000	Total
% Distribution	40%	60%	0%	0%	100%
Weighted Average					**420**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)						80%	20%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.7	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	4.7
	MJ/m².yr	183

TOTAL LIGHTING

Overall LPD	16.47 W/m²	EUI TOTAL	kWh/ft².yr	7.5
	1.53 W/ft²		MJ/m².yr	289

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Servers		Plug Loads	
Measured Power (W/device)	55		51		100		200		217			
Density (device/occupant)	0.5918		0.5918		0.03		0.03		0.06			
Connected Load	0.3	W/m²	0.3	W/m²	0.0	W/m²	0.1	W/m²	0.5	W/m²	2.5	W/m²
	0.0	W/ft²	0.0	W/ft²	0.00	W/ft²	0.01	W/ft²	0.05	W/ft²	0.23	W/ft²
Diversity Occupied Period	90%		90%		90%		90%		100%		90%	
Diversity Unoccupied Period	50%		50%		50%		50%		100%		25%	
Operation Occ. Period (hrs./year)	2000		2000		2600		2600		2600		4100	
Operation Unocc. Period (hrs./year)	6760		6760		6160		6160		6160		4660	

Total end-use load (occupied period)	3.4	W/m²	0.3	W/ft²
Total end-use load (unocc. period)	1.5	W/m²	0.1	W/ft²
Usage during occupied period	100%			
Usage during unoccupied period	44%			

	EUI		
Computer Equipment	EUI	kWh/ft².yr	0.76
		MJ/m².yr	29.58
Plug Loads	EUI	kWh/ft².yr	1.13
		MJ/m².yr	43.70

FOOD SERVICE EQUIPMENT

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	0.1	EUI	kWh/ft².yr	0.1
	MJ/m².yr	5.0		MJ/m².yr	4.0

REFRIGERATION

Provide description below:

Walk-in coolers

EUI	kWh/ft².yr	0.6
	MJ/m².yr	25.0

MISCELLANEOUS

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	0.5	EUI	kWh/ft².yr	0.0
	MJ/m².yr	20.0		MJ/m².yr	0.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Warehouse/Whsale	0		Vancouver Island
Baseline			

SPACE HEATING

Heating Plant Type

							Electric			Other	
				Forced Air						Gas	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Radiant	
System Present (%)	4%	3%	1%	35%	5%	27%		2%	10%	13%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	75%	1.70	3.00	100%	75%	
Performance (1 / Eff.) (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.33	0.59	0.33	1.00	1.33	

Peak Heating Load	22.0 W/m²	7.0 Btu/hr.ft²	
Seasonal Heating Load (Tertiary Load)	197 MJ/m².yr	5.1 kWh/ft².yr	
Sizing Factor	1.00		
Electric Fuel Share	12.0%	Fossil Fuel Share	88.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	4.5
MJ/m².yr	175

Gas EUI	
kWh/ft².yr	6.7
MJ/m².yr	260

Market Composite EUI	
kWh/ft².yr	6.5
MJ/m².yr	251

SPACE COOLING

A/C Plant Type

			WSHP			Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	0.0%	0.0%	0.0%	2.0%	98.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7 °C	44.6 °F
Condenser Water	30 °C	86 °F
Supply Air	13.0 °C	55.4 °F

Peak Cooling Load	41 W/m²	13 Btu/hr.ft²	915 ft²/Ton
Seasonal Cooling Load (Tertiary Load)	63.2 MJ/m².yr	1.6 kWh/ft².yr	

Sizing Factor 1.00 — Operation (occ. period) 3000 hrs/year — Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C) 30.0%

Electric Fuel Share 100.0% — Gas Fuel Share 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	0.7
MJ/m².yr	26

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	0.7
MJ/m².yr	26

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	47%				3%
Eff./COP	0.65				0.75

	Fossil		Elec. Res.
Fuel Share	50%		50%
Blended Efficiency	0.66		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 25.0

Wetting Use Percentage 90%

All Electric EUI	
kWh/ft².yr	0.7
MJ/m².yr	27

Fossil Fuel EUI	
kWh/ft².yr	1.0
MJ/m².yr	38

Market Composite EUI	
kWh/ft².yr	0.8
MJ/m².yr	32.8

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Warehouse/Whsale	0		Vancouver Island
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	2.5	L/s.m²	0.49	CFM/ft²
System Static Pressure CAV	425	Pa	1.7	wg
System Static Pressure VAV	425	Pa	1.7	wg
Fan Efficiency	60%			
Fan Motor Efficiency	80%			
Sizing Factor	1.00			
Fan Design Load CAV	2.2	W/m²	0.20	W/ft²
Fan Design Load VAV	2.2	W/m²	0.20	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	100%	0%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	80%	20%	100%	0%

Comments:

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m²	0.01	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.2	L/s.m²	0.03	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.2	W/m²	0.02	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.020	kW/kW	0.07	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	0.83	W/m²	0.08	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.002	L/s.m²	0.003	U.S. gpm/ft²
Pump Head Pressure	0	kPa	0	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.00	W/m²	0.00	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.002	L/s.m²	0.0026	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	50	kPa	17	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.2	W/m²	0.02	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	16.8	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	1.9	kWh/m².yr
Condenser Pump Energy Consumption	0.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.3	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	0.8	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI		
	kWh/ft².yr	1.8
	MJ/m².yr	71.3

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Warehouse/Whsale	**0**		**Vancouver Island**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**13.6** kWh/ft².yr	**525.8** MJ/m².yr	**Fossil Fuel**	**7.1** kWh/ft².yr	**273.3** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	2.1	83.2
ARCHITECTURAL LIGHTING	0.6	22.4
SPECIAL PURPOSE LIGHTING	4.7	183.1
OTHER PLUG LOADS	1.1	43.7
HVAC FANS & PUMPS	1.8	71.3
REFRIGERATION	0.6	25.0
COMPUTER EQUIPMENT	0.8	29.6
ELEVATORS	0.1	3.9
OUTDOOR LIGHTING	0.4	17.0

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.5	21.0	5.9	229.2
SPACE COOLING	0.2	7.8	0.0	0.0
DOMESTIC HOT WATER	0.4	13.7	0.5	19.1
FOOD SERVICE EQUIPMENT	0.1	4.0	0.1	5.0
MISCELLANEOUS	0.0	0.0	0.5	20.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **Large High Rise** **Baseline** | **SIZE:** **> 9,300 m² (100,000 ft²)** | **VINTAGE:** | **REGION:** **Vancouver Island**

CONSTRUCTION

Wall U value (W/m².°C)	0.81	W/m².°C	0.14	Btu/hr.ft² . °F	Typical Building Size	21,365	m²	229,887	ft²
Roof U value (W/m².°C)	0.56	W/m².°C	0.10	Btu/hr.ft² . °F	Typical Footprint (m²)	1,125	m²	12,100	ft²
Glazing U value (W/m².°C)	4.26	W/m².°C	0.75	Btu/hr.ft² . °F	Footprint Aspect Ratio (L:W)	2			
					Percent Conditioned Space	100%			
					Percent Conditioned Space Defined as Exterior Zone	45%			
Window/Wall Ratio (WIWAR) (%)	0.25								
Shading Coefficient (SC)	0.65				Typical # Stories	19			
					Floor to Floor Height (m)	3.7	m	12.0	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	100%		0%		0%		0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	40	m²/person	430	ft²/person
Occupancy Schedule Occ. Period	25%			
Occupancy Schedule Unocc. Period	80%			
Fresh Air Requirements or Outside Air	10	L/s.person	21	CFM/person

%OA 100.00%

Fresh Air Control Type *(enter a 1, 2 or 3) 3
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right:	0%			
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation	0.25	L/s.m²	0.05	CFM/ft²
	75%	operation (%)		

Sizing Factor	1			
Total Air Circulation or Design Air Flow	0.25	L/s.m²	0.05	CFM/ft²
Infiltration Rate	0.05	L/s.m²	0.01	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)		L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based	Total
Incidence of Use	0%		100%	100%
Switchover Point		KJ/kg.	18	°C
		Btu/lbm	64.4	°F

Summary of Design Parameters		
Peak Design Cooling Load	2,953,498	
Peak Zone Sensible Load	1,871,820	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	87,077	
Total air circulation or Design air	1.92	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	20	°C	68	°F	13	°C	55.4	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	20.4	°C	68.72	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large High Rise	> 9,300 m² (100,000 ft²)		Vancouver Island
Baseline			

LIGHTING

GENERAL (Linear Fluorescent) LIGHTING

Light Level	160	Lux	14.9	ft-candles
Floor Fraction (GLFF)	0.10			
Connected Load	4.6	W/m²	0.4	W/ft²

Occ. Period(Hrs./yr.)	3400
Unocc. Period(Hrs./yr.)	5360
Usage During Occupied Period	90%
Usage During Unoccupied Period	90%

Light Level (Lux)	50	100	200	300				Total
% Distribution	0%	60%	20%	20%				100%
Weighted Average								**160**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			60.0%	0%	40.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

Fixture Cleaning:
Incidence of Practice
Interval — years

Relamping Strategy & Incidence of Practice	Group	Spot

EUI	kWh/ft².yr	0.3
	MJ/m².yr	13

ARCHITECTURAL (Incandescent & replacements) LIGHTING

Light Level	130	Lux	12.1	ft-candles
Floor Fraction (ALFF)	0.90			
Connected Load	13.7	W/m²	1.3	W/ft²

Occ. Period(Hrs./yr.)	2900
Unocc. Period(Hrs./yr.)	5860
Usage During Occupied Period	25%
Usage During Unoccupied Period	20%

Light Level (Lux)	50	200	300	500				Total
% Distribution	60%	20%	20%	0%				100%
Weighted Average								**130**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	60%	40%					0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

Fixture Cleaning:
Incidence of Practice
Interval — years

Relamping Strategy & Incidence of Practice	Group	Spot

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	2.2
	MJ/m².yr	84

SPECIAL PURPOSE LIGHTING

Light Level	0.00	Lux	0.0	ft-candles
Floor Fraction (HBLFF)	0.00			
Connected Load	0.0	W/m²	0.0	W/ft²

Floor fraction check: should = 1.00 — 1.00

Occ. Period(Hrs./yr.)	4000
Unocc. Period(Hrs./yr.)	4760
Usage During Occupied Period	0%
Usage During Unoccupied Period	100%

Light Level (Lux)	300	500	700	1000				Total
% Distribution		0%	0%	0%				0%
Weighted Average								**0**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)								0.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

Fixture Cleaning:
Incidence of Practice
Interval — years

Relamping Strategy & Incidence of Practice	Group	Spot

EUI	kWh/ft².yr	0.0
	MJ/m².yr	0

TOTAL LIGHTING

Overall LPD	12.80 W/m²	EUI TOTAL	kWh/ft².yr	2.5
	1.19 W/ft²		MJ/m².yr	97

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Servers		Plug Loads	
Measured Power (W/device)	45		57		100		200		50			
Density (device/occupant)	0.6		0.6		0		0		0.00			
Connected Load	0.7	W/m²	0.9	W/m²	0.0	W/m²	0.0	W/m²	0.5	W/m²	1.3	W/m²
	0.1	W/ft²	0.1	W/ft²	0.00	W/ft²	0.00	W/ft²	0.05	W/ft²	0.12	W/ft²
Diversity Occupied Period	0%		0%		90%		90%		100%		40%	
Diversity Unoccupied Period	50%		50%		50%		10%		100%		85%	
Operation Occ. Period (hrs./year)	2900		2900		2600		2600		2600		3000	
Operation Unocc. Period (hrs./year)	5860		5860		6160		6160		6160		5760	

Total end-use load (occupied period)	1.0	W/m²	0.1	W/ft²
Total end-use load (unocc. period)	2.4	W/m²	0.2	W/ft²

Usage during occupied period	100%
Usage during unoccupied period	231%

Computer Equipment	EUI	kWh/ft².yr	0.84
		MJ/m².yr	32.38
Plug Loads	EUI	kWh/ft².yr	0.74
		MJ/m².yr	28.53

FOOD SERVICE EQUIPMENT

Provide description below:
Electric stoves (at 417 kWh/yr), etc.

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	0.3	EUI	kWh/ft².yr	0.7
	MJ/m².yr	10.0		MJ/m².yr	27.0

REFRIGERATION

Provide description below:
Residential refrigerators (560 kWh/yr) and freezers (370 kWh/yr)

EUI	kWh/ft².yr	0.8
	MJ/m².yr	30.0

MISCELLANEOUS

Provide description below:
Dryers, pools, fireplaces

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	1.0	EUI	kWh/ft².yr	0.0
	MJ/m².yr	40.0		MJ/m².yr	0.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **Large High Rise** **Baseline**

SIZE: **> 9,300 m² (100,000 ft²)**

VINTAGE:

REGION: **Vancouver Island**

SPACE HEATING

Heating Plant Type

	Stan.	High	Cond.	Forced Air RTU	Forced Air Furnace	Unit Heater	Electric A/A HP	Electric W. S. HP	Electric Resistance	Other District Heat	Total
System Present (%)	35%	20%	5%	20%	5%	0%	3%	3%	9%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff. (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	19.6 W/m²	6.2 Btu/hr.ft²	
Seasonal Heating Load (Tertiary Load)	264 MJ/m².yr	6.8 kWh/ft².yr	
Sizing Factor	1.00		
Electric Fuel Share	15.0%	Fossil Fuel Share	85.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

	All Electric EUI	Gas EUI	Market Composite EUI
kWh/ft².yr	5.3	8.8	8.3
MJ/m².yr	207	341	321

SPACE COOLING

A/C Plant Type

	Standard	HE	WSHP			Absorption Chillers W. H.	Absorption Chillers CW	Total
System Present (%)	1.0%	0.0%		5.0%	94.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7 °C	44.6 °F
Condenser Water	30 °C	86 °F
Supply Air	13.0 °C	55.4 °F

Peak Cooling Load	6 W/m²	2 Btu/hr.ft²	6227 ft²/Ton
Seasonal Cooling Load (Tertiary Load)	64.6 MJ/m².yr	1.7 kWh/ft².yr	
Sizing Factor	0.15	Operation (occ. period)	3000 hrs/year Note value cannot be less than 2,900 hrs/year)
A/C Saturation (Incidence of A/C)	11.0%		
Electric Fuel Share	100.0%	Gas Fuel Share	0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenan

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

	All Electric EUI	Natural Gas EUI	Market Composite EUI
kWh/ft².yr	0.4	0.0	0.4
MJ/m².yr	17	0	17

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	25%				50%
Eff./COP	0.65				0.75

	Fossil		Elec. Res.
Fuel Share	75%		25%
Blended Efficiency	0.72		1.00

Service Hot Water load (MJ/m².yr) (Tertiary Load): 200.0

Wetting Use Percentage: 80%

	All Electric EUI	Fossil Fuel EUI	Market Composite EUI
kWh/ft².yr	5.2	7.2	6.7
MJ/m².yr	200	279	259.3

EXISTING BUILDINGS: **Large High Rise** **Baseline**
SIZE: **> 9,300 m² (100,000 ft²)**
VINTAGE:
REGION: **Vancouver Island**

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	0.3	L/s.m²	0.05	CFM/ft²
System Static Pressure CAV	625	Pa	2.5	wg
System Static Pressure VAV	0	Pa	0.0	wg
Fan Efficiency	52%			
Fan Motor Efficiency	90%			
Sizing Factor	1.00			
Fan Design Load CAV	0.3	W/m²	0.03	W/ft²
Fan Design Load VAV	0.0	W/m²	0.00	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	100%	0%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	75%	25%	75%	25%
Comments:				

EXHAUST FANS

Washroom Exhaust	50	L/s.washroom	106	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m²	0.02	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.2	L/s.m²	0.04	CFM/ft²
Exhaust System Static Pressure	125	Pa	0.5	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.1	W/m²	0.01	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.000	kW/kW	0.00	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	0.00	W/m²	0.00	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.000	L/s.m²	0.000	U.S. gpm/ft²
Pump Head Pressure	0	kPa	0	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.00	W/m²	0.00	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.000	L/s.m²	0.0004	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.1	W/m²	0.00	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	2.5	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	0.9	kWh/m².yr
Condenser Pump Energy Consumption	0.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.0	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	0.3	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI		
	kWh/ft².yr	0.3
	MJ/m².yr	13.3

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Large High Rise	**> 9,300 m² (100,000 ft²)**		**Vancouver Island**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**8.9**	kWh/ft².yr	**343.9**	MJ/m².yr	**Fossil Fue**	**14.2** kWh/ft².yr	**549.6** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL (Linear Fluorescent) LIGHT	0.3	13.1
ARCHITECTURAL (Incandescent & re	2.2	84.3
SPECIAL PURPOSE LIGHTING	0.0	0.0
OTHER PLUG LOADS	0.7	28.5
HVAC FANS & PUMPS	0.3	13.3
REFRIGERATION	0.8	30.0
COMPUTER EQUIPMENT	0.8	32.4
ELEVATORS	0.4	15.5
OUTDOOR LIGHTING	0.4	17.0

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.8	31.0	7.5	290.2
SPACE COOLING	0.0	1.9	0.0	0.0
DOMESTIC HOT WATER	1.3	50.0	5.4	209.3
FOOD SERVICE EQUIPMENT	0.7	27.0	0.3	10.0
MISCELLANEOUS	0.0	0.0	1.0	40.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **SIZE:** **VINTAGE:** **REGION:**

Medium Apartment **Vancouver Island**

Baseline

CONSTRUCTION

Wall U value (W/m².°C)	0.81 W/m².°C	0.14 Btu/hr.ft² . °F	Typical Building Size	8,000 m²	86,080 ft²
Roof U value (W/m².°C)	0.56 W/m².°C	0.10 Btu/hr.ft² . °F	Typical Footprint (m²)	1,600 m²	17,216 ft²
Glazing U value (W/m².°C)	4.26 W/m².°C	0.75 Btu/hr.ft² . °F	Footprint Aspect Ratio (L:W)	3	
			Percent Conditioned Space	100%	
			Percent Conditioned Space Defined as Exterior Zone	45%	
Window/Wall Ratio (WIWAR) (%)	0.25				
Shading Coefficient (SC)	0.65		Typical # Stories	5	
			Floor to Floor Height (m)	3.7 m	12.0 ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	100%		0%		0%		0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	40 m²/person	430 ft²/person	%OA 100.00%
Occupancy Schedule Occ. Period	25%		
Occupancy Schedule Unocc. Period	80%		
Fresh Air Requirements or Outside Air	10 L/s.person	21 CFM/person	

Fresh Air Control Type *(enter a 1, 2 or 3) 3
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right: 0%
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation 0.25 L/s.m² 0.05 CFM/ft²
75% operation (%)

Sizing Factor	1	
Total Air Circulation or Design Air Flow	0.25 L/s.m²	0.05 CFM/ft²

Separate Make-up air unit (100% OA) L/s.m² 0.00 CFM/ft²

Infiltration Rate 0.05 L/s.m² 0.01 CFM/ft²
(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Operation occupied period 50%
Operation unoccupied period 50%

Economizer

	Enthalpy Based		Dry-Bulb Based	Total
Incidence of Use	0%		100%	100%
Switchover Point		KJ/kg.	18 °C	
		Btu/lbm	64.4 °F	

Summary of Design Parameters		
Peak Design Cooling Load	1,081,705	
Peak Zone Sensible Load	676,687	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	31,479	
Total air circulation or Design air	1.86	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	20	°C	68	°F	13	°C	55.4	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	20.4	°C	68.72	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Apartment			Vancouver Island
Baseline			

LIGHTING

GENERAL (Linear Fluorescent) LIGHTING

Light Level	160	Lux	14.9	ft-candles
Floor Fraction (GLFF)	0.10			
Connected Load	4.6	W/m²	0.4	W/ft²

Occ. Period(Hrs./yr.)	3400
Unocc. Period(Hrs./yr.)	5360
Usage During Occupied Period	90%
Usage During Unoccupied Period	90%

Light Level (Lux)	50	100	200	300	Total
% Distribution	0%	60%	20%	20%	100%
Weighted Average					**160**

Fixture Cleaning:
Incidence of Practice
Interval years

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			60.0%	0%	40.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

Relamping Strategy & Incidence of Practice: Group | Spot

EUI	kWh/ft².yr	0.3
	MJ/m².yr	13

ARCHITECTURAL (Incandescent & replacements) LIGHTING

Light Level	130	Lux	12.1	ft-candles
Floor Fraction (ALFF)	0.90			
Connected Load	13.7	W/m²	1.3	W/ft²

Occ. Period(Hrs./yr.)	2900
Unocc. Period(Hrs./yr.)	5860
Usage During Occupied Period	25%
Usage During Unoccupied Period	20%

Light Level (Lux)	50	200	300	500	Total
% Distribution	60%	20%	20%	0%	100%
Weighted Average					**130**

Fixture Cleaning:
Incidence of Practice
Interval years

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	60%	40%					0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

Relamping Strategy & Incidence of Practice: Group | Spot

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	2.2
	MJ/m².yr	84

SPECIAL PURPOSE LIGHTING

Light Level	0.00	Lux	0.0	ft-candles
Floor Fraction (HBLFF)	0.00			
Connected Load	0.0	W/m²	0.0	W/ft²

Floor fraction check: should = 1.00 | 1.00

Occ. Period(Hrs./yr.)	4000
Unocc. Period(Hrs./yr.)	4760
Usage During Occupied Period	0%
Usage During Unoccupied Period	100%

Light Level (Lux)	300	500	700	1000	Total
% Distribution		0%	0%	0%	0%
Weighted Average					**0**

Fixture Cleaning:
Incidence of Practice
Interval years

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)								0.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

Relamping Strategy & Incidence of Practice: Group | Spot

EUI	kWh/ft².yr	0.0
	MJ/m².yr	0

TOTAL LIGHTING

Overall LPD	12.80 W/m²	EUI TOTAL	kWh/ft².yr	2.5
	1.19 W/ft²		MJ/m².yr	97

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Servers	Plug Loads
Measured Power (W/device)	45	57	100	200	50	
Density (device/occupant)	0.6	0.6	0	0	0.00	
Connected Load	0.7 W/m²	0.9 W/m²	0.0 W/m²	0.0 W/m²	0.5 W/m²	1.3 W/m²
	0.1 W/ft²	0.1 W/ft²	0.00 W/ft²	0.00 W/ft²	0.05 W/ft²	0.12 W/ft²
Diversity Occupied Period	0%	0%	90%	90%	100%	40%
Diversity Unoccupied Period	50%	50%	50%	10%	100%	85%
Operation Occ. Period (hrs./year)	2900	2900	2600	2600	2600	3000
Operation Unocc. Period (hrs./year)	5860	5860	6160	6160	6160	5760

Total end-use load (occupied period)	1.0 W/m²	0.1 W/ft²
Total end-use load (unocc. period)	2.4 W/m²	0.2 W/ft²
Usage during occupied period	100%	
Usage during unoccupied period	231%	

Computer Equipment	EUI	kWh/ft².yr	0.84
		MJ/m².yr	32.38
Plug Loads	EUI	kWh/ft².yr	0.74
		MJ/m².yr	28.53

FOOD SERVICE EQUIPMENT

Provide description below:
Electric stoves (at 417 kWh/yr), etc.

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	0.1	EUI	kWh/ft².yr	0.7
	MJ/m².yr	5.0		MJ/m².yr	27.0

REFRIGERATION

Provide description below:
Residential refrigerators (560 kWh/yr) and freezers (370 kWh/yr)

EUI	kWh/ft².yr	0.8
	MJ/m².yr	30.0

MISCELLANEOUS

Provide description below:
pools, dryers, fireplaces, bbq etc

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	0.8	EUI	kWh/ft².yr	0.0
	MJ/m².yr	30.0		MJ/m².yr	0.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **SIZE:** **VINTAGE:** **REGION:**

Medium Apartment **Vancouver Island**

Baseline

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	30%	10%	5%	20%	15%	0%	3%	3%	14%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff.) (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	19.9 W/m²	6.3 Btu/hr.ft²	
Seasonal Heating Load (Tertiary Load)	269 MJ/m².yr	6.9 kWh/ft².yr	
Sizing Factor	1.00		
Electric Fuel Share	20.0%	Fossil Fuel Share	80.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	5.8
MJ/m².yr	225

Gas EUI	
kWh/ft².yr	9.0
MJ/m².yr	348

Market Composite EUI	
kWh/ft².yr	8.3
MJ/m².yr	323

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	0.0%	0.0%		0.0%	100.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7 °C	44.6 °F
Condenser Water	30 °C	86 °F
Supply Air	13.0 °C	55.4 °F

Peak Cooling Load	6 W/m²	2 Btu/hr.ft²	6366 ft²/Ton
Seasonal Cooling Load (Tertiary Load)	61.6 MJ/m².yr	1.6 kWh/ft².yr	

Sizing Factor 0.15 Operation (occ. period) 3000 hrs/year Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C) 11.0%

Electric Fuel Share 100.0% Gas Fuel Share 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

All Electric EUI	
kWh/ft².yr	0.4
MJ/m².yr	17

Cooling Tower/Air Cooled Condenser Maintenan

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	0.4
MJ/m².yr	17

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank					Boiler
System Present (%)	50%					20%
Eff./COP	0.65					0.75

	Fossil		Elec. Res.
Fuel Share	70%		30%
Blended Efficiency	0.68		1.00

Service Hot Water load (MJ/m².yr) (Tertiary Load) 180.0

Wetting Use Percentage 80%

All Electric EUI	
kWh/ft².yr	4.6
MJ/m².yr	180

Fossil Fuel EUI	
kWh/ft².yr	6.8
MJ/m².yr	265

Market Composite EUI	
kWh/ft².yr	6.2
MJ/m².yr	239.7

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Medium Apartment			**Vancouver Island**
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	0.3	L/s.m²	0.05	CFM/ft²
System Static Pressure CAV	625	Pa	2.5	wg
System Static Pressure VAV	0	Pa	0.0	wg
Fan Efficiency	52%			
Fan Motor Efficiency	90%			
Sizing Factor	1.00			
Fan Design Load CAV	0.3	W/m²	0.03	W/ft²
Fan Design Load VAV	0.0	W/m²	0.00	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	100%	0%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	75%	25%	75%	25%
Comments:				

EXHAUST FANS

Washroom Exhaust	50	L/s.washroom	106	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m²	0.01	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.2	L/s.m²	0.03	CFM/ft²
Exhaust System Static Pressure	125	Pa	0.5	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.1	W/m²	0.01	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.000	kW/kW	0.00	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	0.00	W/m²	0.00	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.000	L/s.m²	0.000	U.S. gpm/ft²
Pump Head Pressure	0	kPa	0	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.00	W/m²	0.00	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.000	L/s.m²	0.0004	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.1	W/m²	0.00	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	2.5	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	0.8	kWh/m².yr
Condenser Pump Energy Consumption	0.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.0	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	0.3	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI	kWh/ft².yr	0.3
	MJ/m².yr	12.8

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Medium Apartment			**Vancouver Island**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**9.2** kWh/ft².yr	**357.6** MJ/m².yr	**Fossil Fue**	**12.9** kWh/ft².yr	**498.9** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL (Linear Fluorescent) LIGHT	0.3	13.1
ARCHITECTURAL (Incandescent & re	2.2	84.3
SPECIAL PURPOSE LIGHTING	0.0	0.0
OTHER PLUG LOADS	0.7	28.5
HVAC FANS & PUMPS	0.3	12.8
REFRIGERATION	0.8	30.0
COMPUTER EQUIPMENT	0.8	32.4
ELEVATORS	0.3	11.6
OUTDOOR LIGHTING	0.4	17.0

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	1.2	45.1	7.2	278.2
SPACE COOLING	0.0	1.8	0.0	0.0
DOMESTIC HOT WATER	1.4	54.0	4.8	185.7
FOOD SERVICE EQUIPMENT	0.7	27.0	0.1	5.0
MISCELLANEOUS	0.0	0.0	0.8	30.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Office	**> 9,300 m² (100,000 ft²)**		**Inland North**
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.91	W/m².°C	0.16	Btu/hr.ft² . °F	Typical Building Size	21,365	m²	229,887	ft²
Roof U value (W/m².°C)	0.61	W/m².°C	0.11	Btu/hr.ft² . °F	Typical Footprint (m²)	1,526	m²	16,421	ft²
Glazing U value (W/m².°C)	4.29	W/m².°C	0.75	Btu/hr.ft² . °F	Footprint Aspect Ratio (L:W)	1			
					Percent Conditioned Space	100%			
					Percent Conditioned Space Defined as Exterior Zone	45%			
Window/Wall Ratio (WIWAR) (%)	0.41								
Shading Coefficient (SC)	0.58				Typical # Stories	14			
					Floor to Floor Height (m)	3.7	m	12.0	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	50%		0%		50%		0%		100%
Min. Air Flow (%)					40%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	26	m²/person	274	ft²/person	%OA	14.27%
Occupancy Schedule Occ. Period	90%					
Occupancy Schedule Unocc. Period	0%					
Fresh Air Requirements or Outside Air	20	L/s.person	42	CFM/person		

Fresh Air Control Type *(enter a 1, 2 or 3): 1
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right:
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation | L/s.m² | 0.00 CFM/ft² | operation (%)

Sizing Factor	1.6			
Total Air Circulation or Design Air Flow	5.50	L/s.m²	1.08	CFM/ft²
Infiltration Rate	0.70	L/s.m²	0.14	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)		L/s.m²	0.00 CFM/ft²
Operation occupied period	50%		
Operation unoccupied period	50%		

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	6,821,781	
Peak Zone Sensible Load	3,343,021	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	155,517	
Total air circulation or Design air	5.50	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	24	°C	75.2	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				98%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	19.5	°C	67.1	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning — Changes/Year:

Incidence of Annual Room Controls Maintenance:

Incidence of Annual HVAC Controls Maintenance:

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Large Office	**> 9,300 m² (100,000 ft²)**		**Inland North**
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	600	Lux	55.8	ft-candles
Floor Fraction (GLFF)	0.90			
Connected Load	16.6	W/m²	1.5	W/ft²

Occ. Period(Hrs./yr.)	2900
Unocc. Period(Hrs./yr.)	5860
Usage During Occupied Period	95%
Usage During Unoccupied Period	35%

Light Level (Lux)	500	600	700	800	Total
% Distribution	25%	50%	25%	0%	100%
Weighted Average					**600**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			37.5%	0%	62.5%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

Fixture Cleaning:
Incidence of Practice
Interval years

Relamping Strategy & Incidence of Practice: Group | Spot

EUI	kWh/ft².yr	6.7
	MJ/m².yr	259

ARCHITECTURAL LIGHTING

Light Level	350	Lux	32.5	ft-candles
Floor Fraction (ALFF)	0.10			
Connected Load	29.7	W/m²	2.8	W/ft²

Occ. Period(Hrs./yr.)	3400
Unocc. Period(Hrs./yr.)	5360
Usage During Occupied Period	95%
Usage During Unoccupied Period	50%

Light Level (Lux)	200	300	400	500	Total
% Distribution	10%	40%	40%	10%	100%
Weighted Average					**350**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	40%	60%					0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

Fixture Cleaning:
Incidence of Practice
Interval years

Relamping Strategy & Incidence of Practice: Group | Spot

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	1.6
	MJ/m².yr	63

SPECIAL PURPOSE LIGHTING

Light Level	0.00	Lux	0.0	ft-candles
Floor Fraction (HBLFF)	0.00			
Connected Load	0.0	W/m²	0.0	W/ft²

Floor fraction check: should = 1.00 | 1.00

Occ. Period(Hrs./yr.)	4000
Unocc. Period(Hrs./yr.)	4760
Usage During Occupied Period	0%
Usage During Unoccupied Period	100%

Light Level (Lux)	300	500	700	1000	Total
% Distribution		0%	0%	0%	0%
Weighted Average					**0**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)								0.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

Fixture Cleaning:
Incidence of Practice
Interval years

Relamping Strategy & Incidence of Practice: Group | Spot

EUI	kWh/ft².yr	0.0
	MJ/m².yr	0

TOTAL LIGHTING

Overall LPD	17.94 W/m²	EUI TOTAL	kWh/ft².yr	8.3
	1.67 W/ft²		MJ/m².yr	322

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Servers		Plug Loads	
Measured Power (W/device)	55		51		100		200		217			
Density (device/occupant)	0.9		0.9		0.15		0.1		0.06			
Connected Load	1.9	W/m²	1.8	W/m²	0.6	W/m²	0.8	W/m²	0.5	W/m²	2.5	W/m²
	0.2	W/ft²	0.2	W/ft²	0.05	W/ft²	0.07	W/ft²	0.05	W/ft²	0.23	W/ft²
Diversity Occupied Period	90%		90%		90%		90%		100%		90%	
Diversity Unoccupied Period	50%		50%		50%		50%		100%		25%	
Operation Occ. Period (hrs./year)	2500		2500		2500		2500		2500		3000	
Operation Unocc. Period (hrs./year)	6260		6260		6260		6260		6260		5760	

Total end-use load (occupied period)	7.3	W/m²	0.7	W/ft²
Total end-use load (unocc. period)	3.7	W/m²	0.3	W/ft²

Usage during occupied period	100%
Usage during unoccupied period	50%

Computer Equipment	EUI	kWh/ft².yr	2.96
		MJ/m².yr	114.76
Plug Loads	EUI	kWh/ft².yr	0.96
		MJ/m².yr	37.26

FOOD SERVICE EQUIPMENT

Provide description below:
Cafeteria

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	0.3	EUI	kWh/ft².yr	0.1
	MJ/m².yr	10.0		MJ/m².yr	3.0

REFRIGERATION

Provide description below:
Cafeteria

EUI	kWh/ft².yr	0.1
	MJ/m².yr	4.0

MISCELLANEOUS

Provide description below:

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	0.5	EUI	kWh/ft².yr	0.0
	MJ/m².yr	20.0		MJ/m².yr	0.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Office	> 9,300 m² (100,000 ft²)		Inland North
Baseline			

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	65%	15%	5%	10%	0%	0%	1%	1%	3%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff. (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	72.7 W/m²	23.1 Btu/hr.ft²	
Seasonal Heating Load (Tertiary Load)	427 MJ/m².yr	11.0 kWh/ft².yr	
Sizing Factor	1.00		
Electric Fuel Share	5.0%	Fossil Fuel Share	95.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	8.6
MJ/m².yr	335

Gas EUI	
kWh/ft².yr	14.4
MJ/m².yr	559

Market Composite EUI	
kWh/ft².yr	14.1
MJ/m².yr	548

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	56.0%	24.0%		5.0%	15.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7 °C	44.6 °F
Condenser Water	30 °C	86 °F
Supply Air	14.0 °C	57.2 °F

Peak Cooling Load	94 W/m²	30 Btu/hr.ft²	404 ft²/Ton
Seasonal Cooling Load (Tertiary Load)	131.2 MJ/m².yr	3.4 kWh/ft².yr	

Sizing Factor 1.00 Operation (occ. period) 3000 hrs/year Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C) 90.0%

Electric Fuel Share 100.0% Gas Fuel Share 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenan

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	1.4
MJ/m².yr	54

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	1.4
MJ/m².yr	54

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	40%				20%
Eff./COP	0.65				0.75

	Fossil	Elec. Res.
Fuel Share	60%	40%
Blended Efficiency	0.68	0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 40.0

Wetting Use Percentage 90%

All Electric EUI	
kWh/ft².yr	1.1
MJ/m².yr	44

Fossil Fuel EUI	
kWh/ft².yr	1.5
MJ/m².yr	59

Market Composite EUI	
kWh/ft².yr	1.4
MJ/m².yr	52.7

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **Large Office** **Baseline**
SIZE: **> 9,300 m² (100,000 ft²)**
VINTAGE:
REGION: **Inland North**

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	5.5	L/s.m²	1.08	CFM/ft²
System Static Pressure CAV	875	Pa	3.5	wg
System Static Pressure VAV	875	Pa	3.5	wg
Fan Efficiency	52%			
Fan Motor Efficiency	90%			
Sizing Factor	1.00			
Fan Design Load CAV	10.3	W/m²	0.96	W/ft²
Fan Design Load VAV	10.3	W/m²	0.96	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	50%	50%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	50%	50%	50%	50%
Comments:				

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m²	0.03	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.2	L/s.m²	0.05	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	40%			
Fan Motor Efficiency	80%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.2	W/m²	0.02	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.020	kW/kW	0.07	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	1.87	W/m²	0.17	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.005	L/s.m²	0.007	U.S. gpm/ft²
Pump Head Pressure	90	kPa	30	ft
Pump Efficiency	55%			
Pump Motor Efficiency	90%			
Sizing Factor	1.0			
Pump Connected Load	0.90	W/m²	0.08	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.004	L/s.m²	0.0059	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	150	kPa	50	ft		
Pump Efficiency	55%					
Pump Motor Efficiency	90%					
Sizing Factor	0.8					
Pump Connected Load	1.0	W/m²	0.09	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	47.6	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	1.1	kWh/m².yr
Condenser Pump Energy Consumption	2.5	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.7	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	4.9	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI		
	kWh/ft².yr	5.3
	MJ/m².yr	204.4

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Large Office	**> 9,300 m² (100,000 ft²)**		**Inland North**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**20.7** kWh/ft².yr	**800.7** MJ/m².yr	**Fossil Fuel**	**15.4** kWh/ft².yr	**595.9** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	6.7	259.0
ARCHITECTURAL LIGHTING	1.6	63.3
SPECIAL PURPOSE LIGHTING	0.0	0.0
OTHER PLUG LOADS	1.0	37.3
HVAC FANS & PUMPS	5.3	204.4
REFRIGERATION	0.1	4.0
COMPUTER EQUIPMENT	3.0	114.8
ELEVATORS	0.4	15.5
OUTDOOR LIGHTING	0.4	17.0

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.4	16.7	13.7	530.8
SPACE COOLING	1.2	48.2	0.0	0.0
DOMESTIC HOT WATER	0.5	17.6	0.9	35.1
FOOD SERVICE EQUIPMENT	0.1	3.0	0.3	10.0
MISCELLANEOUS	0.0	0.0	0.5	20.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Office	50,000 to 100,000 ft²		Inland North
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.88	W/m².°C	0.15	Btu/hr.ft² . °F
Roof U value (W/m².°C)	0.61	W/m².°C	0.11	Btu/hr.ft² . °F
Glazing U value (W/m².°C)	4.29	W/m².°C	0.75	Btu/hr.ft² . °F
Window/Wall Ratio (WIWAR) (%)	0.36			
Shading Coefficient (SC)	0.58			

Typical Building Size	6,777	m²	72,921	ft²
Typical Footprint (m²)	753	m²	8,102	ft²
Footprint Aspect Ratio (L:W)	1			
Percent Conditioned Space	100%			
Percent Conditioned Space Defined as Exterior Zone	45%			
Typical # Stories	9			
Floor to Floor Height (m)	3.7	m	12.0	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	75%		0%		25%		0%		100%
Min. Air Flow (%)					60%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	26	m²/person	274	ft²/person
Occupancy Schedule Occ. Period	90%			
Occupancy Schedule Unocc. Period	0%			
Fresh Air Requirements or Outside Air	15	L/s.person	32	CFM/person

%OA 10.66%

Fresh Air Control Type *(enter a 1, 2 or 3) 1
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)
If Fresh Air Control Type = "2" enter % FA. to the right:
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation — L/s.m² — 0.00 CFM/ft² — operation (%)

Sizing Factor	1.5			
Total Air Circulation or Design Air Flow	5.52	L/s.m²	1.09	CFM/ft²
Infiltration Rate	0.70	L/s.m²	0.14	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)		L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	1,978,508	
Peak Zone Sensible Load	1,135,660	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	52,831	
Total air circulation or Design air	5.52	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	24	°C	75.2	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				98%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	19.5	°C	67.1	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning — Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Medium Office	**50,000 to 100,000 ft²**		**Inland North**
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	600	Lux	55.8	ft-candles
Floor Fraction (GLFF)	0.92			
Connected Load	16.6	W/m²	1.5	W/ft²
Occ. Period(Hrs./yr.)	2900			
Unocc. Period(Hrs./yr.)	5860			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	30%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	500	600	700	800	Total
% Distribution	25%	50%	25%	0%	100%
Weighted Average					**600**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			37.5%		62.5%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI kWh/ft².yr 6.4
MJ/m².yr 249

ARCHITECTURAL LIGHTING

Light Level	350	Lux	32.5	ft-candles
Floor Fraction (ALFF)	0.07			
Connected Load	31.5	W/m²	2.9	W/ft²
Occ. Period(Hrs./yr.)	3400			
Unocc. Period(Hrs./yr.)	5360			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	40%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	200	300	400	500	Total
% Distribution	10%	40%	40%	10%	100%
Weighted Average					**350**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	45%	55%					0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI kWh/ft².yr 1.1
MJ/m².yr 43

SPECIAL PURPOSE LIGHTING

Light Level	0.00	Lux	0.0	ft-candles
Floor Fraction (HBLFF)	0.01			
Connected Load	0.0	W/m²	0.0	W/ft²
Occ. Period(Hrs./yr.)	3400			
Unocc. Period(Hrs./yr.)	5360			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	40%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 — 1.00

Light Level (Lux)	300	500	700	1000	Total
% Distribution		0%	0%	0%	0%
Weighted Average					**0**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)						50%	50%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI kWh/ft².yr 0.0
MJ/m².yr 0

TOTAL LIGHTING

Overall LPD 17.51 W/m²
1.63 W/ft²

EUI TOTAL kWh/ft².yr 7.5
MJ/m².yr 291

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Servers	Plug Loads
Measured Power (W/device)	55	51	100	200	217	
Density (device/occupant)	0.9	0.9	0.15	0.1	0.06	
Connected Load	1.9 W/m²	1.8 W/m²	0.6 W/m²	0.8 W/m²	0.5 W/m²	1 W/m²
	0.2 W/ft²	0.2 W/ft²	0.05 W/ft²	0.07 W/ft²	0.05 W/ft²	0.09 W/ft²
Diversity Occupied Period	90%	90%	90%	90%	100%	80%
Diversity Unoccupied Period	50%	50%	50%	50%	100%	25%
Operation Occ. Period (hrs./year)	2500	2500	2500	2500	2500	2500
Operation Unocc. Period (hrs./year)	6260	6260	6260	6260	6260	6260

Total end-use load (occupied period)	5.9 W/m²	0.5 W/ft²
Total end-use load (unocc. period)	3.3 W/m²	0.3 W/ft²
Usage during occupied period	100%	
Usage during unoccupied period	56%	

Computer Equipment	EUI	kWh/ft².yr	2.96
		MJ/m².yr	114.76
Plug Loads	EUI	kWh/ft².yr	0.33
		MJ/m².yr	12.83

FOOD SERVICE EQUIPMENT

Provide description below:

Lunch room/cafeteria/restaurant

	Gas EUI		Electric EUI	
EUI	kWh/ft².yr	0.3	kWh/ft².yr	0.1
	MJ/m².yr	10.0	MJ/m².yr	4.0

REFRIGERATION

Provide description below:

Lunch room/cafeteria/restaurant

EUI kWh/ft².yr 0.1
MJ/m².yr 4.0

MISCELLANEOUS

Provide description below:

	Gas EUI		Electric EUI	
EUI	kWh/ft².yr	0.5	kWh/ft².yr	0.0
	MJ/m².yr	20.0	MJ/m².yr	0.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Office	50,000 to 100,000 ft²		Inland North
Baseline			

SPACE HEATING

Heating Plant Type

							Electric			Other	
				Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	30%	10%	5%	45%	0%	0%	3%	1%	6%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff. (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	78.7	W/m²	25.0	Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	485	MJ/m².yr	12.5	kWh/ft².yr
Sizing Factor	1.00			
Electric Fuel Share	10.0%	Fossil Fuel Share	90.0%	

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	10.1
MJ/m².yr	393

Gas EUI	
kWh/ft².yr	16.4
MJ/m².yr	636

Market Composite EUI	
kWh/ft².yr	15.8
MJ/m².yr	612

SPACE COOLING

A/C Plant Type

			WSHP			Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	5.0%	5.0%	10.0%	30.0%	50.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7	°C	44.6	°F
Condenser Water	30	°C	86	°F
Supply Air	14.0	°C	57.2	°F

Peak Cooling Load	86	W/m²	27	Btu/hr.ft²	442	ft²/Ton
Seasonal Cooling Load (Tertiary Load)	122.8	MJ/m².yr	3.2	kWh/ft².yr		

Sizing Factor 1.00 — Operation (occ. period) 3000 hrs/year Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C) 90.0%

Electric Fuel Share 100.0% — Gas Fuel Share 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	1.4
MJ/m².yr	53

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	1.4
MJ/m².yr	53

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	50%				10%
Eff./COP	0.65				0.75

	Fossil		Elec. Res.
Fuel Share	60%		40%
Blended Efficiency	0.67		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 35.0

Wetting Use Percentage 90%

All Electric EUI	
kWh/ft².yr	1.0
MJ/m².yr	38

Fossil Fuel EUI	
kWh/ft².yr	1.4
MJ/m².yr	53

Market Composite EUI	
kWh/ft².yr	1.2
MJ/m².yr	46.9

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Office	50,000 to 100,000 ft²		Inland North
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	5.5	L/s.m²	1.09	CFM/ft²
System Static Pressure CAV	750	Pa	3.0	wg
System Static Pressure VAV	750	Pa	3.0	wg
Fan Efficiency	52%			
Fan Motor Efficiency	85%			
Sizing Factor	1.00			
Fan Design Load CAV	9.4	W/m²	0.87	W/ft²
Fan Design Load VAV	9.4	W/m²	0.87	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	75%	25%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	75%	25%	75%	25%
Comments:				

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.3	L/s.m²	0.05	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.4	L/s.m²	0.07	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	40%			
Fan Motor Efficiency	80%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.3	W/m²	0.03	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.018	kW/kW	0.06	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	1.53	W/m²	0.14	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.005	L/s.m²	0.007	U.S. gpm/ft²
Pump Head Pressure	90	kPa	30	ft
Pump Efficiency	55%			
Pump Motor Efficiency	90%			
Sizing Factor	1.0			
Pump Connected Load	0.82	W/m²	0.08	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.004	L/s.m²	0.0054	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	150	kPa	50	ft		
Pump Efficiency	55%					
Pump Motor Efficiency	90%					
Sizing Factor	0.5					
Pump Connected Load	0.6	W/m²	0.05	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	64.0	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	2.1	kWh/m².yr
Condenser Pump Energy Consumption	0.8	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.6	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	2.8	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI		
	kWh/ft².yr	6.5
	MJ/m².yr	253.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Medium Office	**50,000 to 100,000 ft²**		**Inland North**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**20.9** kWh/ft².yr	**810.4** MJ/m².yr	**Fossil Fue**	**16.4** kWh/ft².yr	**633.9** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	6.4	248.6
ARCHITECTURAL LIGHTING	1.1	42.7
SPECIAL PURPOSE LIGHTING	0.0	0.0
OTHER PLUG LOADS	0.3	12.8
HVAC FANS & PUMPS	6.5	253.0
REFRIGERATION	0.1	4.0
COMPUTER EQUIPMENT	3.0	114.8
ELEVATORS	0.3	11.6
OUTDOOR LIGHTING	0.4	17.0

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	1.0	39.3	14.8	572.4
SPACE COOLING	1.2	47.3	0.0	0.0
DOMESTIC HOT WATER	0.4	15.4	0.8	31.5
FOOD SERVICE EQUIPMENT	0.1	4.0	0.3	10.0
MISCELLANEOUS	0.0	0.0	0.5	20.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: Large Retail Baseline | **SIZE:** > 100,000 ft² | **VINTAGE:** | **REGION:** Inland North

CONSTRUCTION

Wall U value (W/m².°C)	0.57	W/m².°C	0.10	Btu/hr.ft² . °F
Roof U value (W/m².°C)	0.49	W/m².°C	0.09	Btu/hr.ft² . °F
Glazing U value (W/m².°C)	4.03	W/m².°C	0.71	Btu/hr.ft² . °F
Window/Wall Ratio (WIWAR) (%)	0.10			
Shading Coefficient (SC)	0.75			

Typical Building Size	24,000	m²	258,240	ft²
Typical Footprint (m²)	24,000	m²	258,240	ft²
Footprint Aspect Ratio (L:W)	15			
Percent Conditioned Space	100%			
Percent Conditioned Space Defined as Exterior Zone	40%			
Typical # Stories	1			
Floor to Floor Height (m)	4.6	m	15.0	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	95%		0%		5%		0%		100%
Min. Air Flow (%)					60%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	45	m²/person	484	ft²/person
Occupancy Schedule Occ. Period	90%			
Occupancy Schedule Unocc. Period	0%			
Fresh Air Requirements or Outside Air	30	L/s.person	64	CFM/person

%OA 12.79%

Fresh Air Control Type *(enter a 1, 2 or 3) 1
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right: 0%
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation 0.5 L/s.m² 0.10 CFM/ft²
50% operation (%)

Sizing Factor	1.8			
Total Air Circulation or Design Air Flow	5.21	L/s.m²	1.03	CFM/ft²
Infiltration Rate	0.70	L/s.m²	0.14	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	6,425,926	
Peak Zone Sensible Load	3,165,493	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	147,259	
Total air circulation or Design air	5.21	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	23	°C	73.4	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	21	°C	69.8	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning — Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Retail	> 100,000 ft²		Inland North
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	525	Lux	48.8	ft-candles
Floor Fraction (GLFF)	0.55			
Connected Load	15.1	W/m²	1.4	W/ft²
Occ. Period(Hrs./yr.)	4100			
Unocc. Period(Hrs./yr.)	4660			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	20%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	500	600	700	800	Total
% Distribution	75%	25%	0%	0%	100%
Weighted Average					**525**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			60.0%	0%	40.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	3.7
	MJ/m².yr	145

ARCHITECTURAL LIGHTING

Light Level	505	Lux	46.9	ft-candles
Floor Fraction (ALFF)	0.30			
Connected Load	61.0	W/m²	5.7	W/ft²
Occ. Period(Hrs./yr.)	4100			
Unocc. Period(Hrs./yr.)	4660			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	30%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	400	500	600	700	Total
% Distribution	25%	50%	20%	5%	100%
Weighted Average					**505**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	75%	25%					0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	9.0
	MJ/m².yr	349

SPECIAL PURPOSE LIGHTING

Light Level	500.00	Lux	46.5	ft-candles
Floor Fraction (HBLFF)	0.15			
Connected Load	23.3	W/m²	2.2	W/ft²
Occ. Period(Hrs./yr.)	4100			
Unocc. Period(Hrs./yr.)	4660			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	15%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 | 1.00

Light Level (Lux)	400	500	600	700	Total
% Distribution	40%	30%	20%	10%	100%
Weighted Average					**500**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)						100%		100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	1.5
	MJ/m².yr	58

TOTAL LIGHTING

Overall LPD	26.64 W/m²	EUI TOTAL	kWh/ft².yr	14.2
	2.48 W/ft²		MJ/m².yr	552

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Servers	Plug Loads
Measured Power (W/device)	55	51	100	200	217	
Density (device/occupant)	0.648828	0.648828	0.01	0.01	0.03	
Connected Load	0.8 W/m²	0.7 W/m²	0.0 W/m²	0.0 W/m²	0.5 W/m²	1.75 W/m²
	0.1 W/ft²	0.1 W/ft²	0.00 W/ft²	0.00 W/ft²	0.05 W/ft²	0.16 W/ft²
Diversity Occupied Period	90%	90%	90%	90%	100%	90%
Diversity Unoccupied Period	50%	50%	50%	50%	100%	25%
Operation Occ. Period (hrs./year)	2000	2000	2600	2600	2600	4100
Operation Unocc. Period (hrs./year)	6760	6760	6160	6160	6160	4660

Total end-use load (occupied period)	3.5 W/m²	0.3 W/ft²
Total end-use load (unocc. period)	1.7 W/m²	0.2 W/ft²
Usage during occupied period	100%	
Usage during unoccupied period	50%	

Computer Equipment	EUI	kWh/ft².yr	1.18
		MJ/m².yr	45.81
Plug Loads	EUI	kWh/ft².yr	0.79
		MJ/m².yr	30.59

FOOD SERVICE EQUIPMENT

Provide description below:

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	0.3	EUI	kWh/ft².yr	0.3
	MJ/m².yr	10.0		MJ/m².yr	10.0

REFRIGERATION

Provide description below:

Commercial refrigeration display cases

EUI	kWh/ft².yr	0.3
	MJ/m².yr	10.0

MISCELLANEOUS

Provide description below:

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	0.1	EUI	kWh/ft².yr	0.0
	MJ/m².yr	5.0		MJ/m².yr	0.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Retail	> 100,000 ft²		Inland North
Baseline			

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	10%	8%	2%	60%	10%	0%	3%	2%	5%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff. (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load 60.4 W/m² 19.2 Btu/hr.ft²
Seasonal Heating Load (Tertiary Load) 364 MJ/m².yr 9.4 kWh/ft².yr
Sizing Factor 1.00

Electric Fuel Share 10.0% Fossil Fuel Share 90.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	7.0
MJ/m².yr	270

Gas EUI	
kWh/ft².yr	12.3
MJ/m².yr	477

Market Composite EUI	
kWh/ft².yr	11.8
MJ/m².yr	456

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	10.0%	5.0%	0.0%	0.0%	85.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7	°C	44.6	°F
Condenser Water	30	°C	86	°F
Supply Air	14.0	°C	57.2	°F

Peak Cooling Load 78 W/m² 25 Btu/hr.ft² 482 ft²/Ton
Seasonal Cooling Load (Tertiary Load) 88.5 MJ/m².yr 2.3 kWh/ft².yr

Sizing Factor 1.00 Operation (occ. period) 3000 hrs/year Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C) 80.0%

Electric Fuel Share 100.0% Gas Fuel Share 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenan

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	0.9
MJ/m².yr	36

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	0.9
MJ/m².yr	36

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	35%				15%
Eff./COP	0.65				0.75

	Fossil		Elec. Res.
Fuel Share	50%		50%
Blended Efficiency	0.68		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 35.0

Wetting Use Percentage 90%

All Electric EUI	
kWh/ft².yr	1.0
MJ/m².yr	38

Fossil Fuel EUI	
kWh/ft².yr	1.3
MJ/m².yr	51

Market Composite EUI	
kWh/ft².yr	1.2
MJ/m².yr	45.0

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Retail	> 100,000 ft²		Inland North
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	5.2	L/s.m²	1.03	CFM/ft²
System Static Pressure CAV	500	Pa	2.0	wg
System Static Pressure VAV	750	Pa	3.0	wg
Fan Efficiency	60%			
Fan Motor Efficiency	80%			
Sizing Factor	1.00			
Fan Design Load CAV	5.4	W/m²	0.50	W/ft²
Fan Design Load VAV	8.1	W/m²	0.76	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	95%	5%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	50%	50%	100%	0%
Comments:				

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.0	L/s.m²	0.00	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.1	L/s.m²	0.02	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.1	W/m²	0.01	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.024	kW/kW	0.08	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	1.84	W/m²	0.17	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.004	L/s.m²	0.006	U.S. gpm/ft²
Pump Head Pressure	0	kPa	0	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.00	W/m²	0.00	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.003	L/s.m²	0.0050	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	50	kPa	17	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.3	W/m²	0.03	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	33.3	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	1.3	kWh/m².yr
Condenser Pump Energy Consumption	0.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.5	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	1.7	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI		
	kWh/ft².yr	3.4
	MJ/m².yr	132.5

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Large Retail	**> 100,000 ft²**		**Inland North**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**23.3** kWh/ft².yr	**901.4** MJ/m².yr	**Fossil Fue**	**12.1** kWh/ft².yr	**469.9** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	3.7	144.8
ARCHITECTURAL LIGHTING	9.0	349.0
SPECIAL PURPOSE LIGHTING	1.5	57.8
OTHER PLUG LOADS	0.8	30.6
HVAC FANS & PUMPS	3.4	132.5
REFRIGERATION	0.3	10.0
COMPUTER EQUIPMENT	1.2	45.8
ELEVATORS	0.3	11.6
OUTDOOR LIGHTING	0.9	33.9

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.7	27.0	11.1	429.2
SPACE COOLING	0.8	29.2	0.0	0.0
DOMESTIC HOT WATER	0.5	19.2	0.7	25.7
FOOD SERVICE EQUIPMENT	0.3	10.0	0.3	10.0
MISCELLANEOUS	0.0	0.0	0.1	5.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Retail	50,000 - 100,000 ft2		Inland North
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.57	W/m².°C	0.10	Btu/hr.ft². °F	Typical Building Size	7,500	m²	80,700	ft²
Roof U value (W/m².°C)	0.51	W/m².°C	0.09	Btu/hr.ft². °F	Typical Footprint (m²)	7,500	m²	80,700	ft²
Glazing U value (W/m².°C)	4.03	W/m².°C	0.71	Btu/hr.ft². °F	Footprint Aspect Ratio (L:W)	5			
					Percent Conditioned Space	100%			
					Percent Conditioned Space Defined as Exterior Zone	29%			
Window/Wall Ratio (WIWAR) (%)	0.10								
Shading Coefficient (SC)	0.75				Typical # Stories	1			
					Floor to Floor Height (m)	5.0	m	16.5	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	100%		0%		0%		0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	25	m²/person	269	ft²/person	%OA	7.95%
Occupancy Schedule Occ. Period	90%					
Occupancy Schedule Unocc. Period	0%					
Fresh Air Requirements or Outside Air	10	L/s.person	21	CFM/person		

Fresh Air Control Type *(enter a 1, 2 or 3) | 1 | If Fresh Air Control Type = "2" enter % FA. to the right: 34%
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air) | If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation 0.5 L/s.m² 0.10 CFM/ft²; 50% operation (%)

Sizing Factor	1.5			
Total Air Circulation or Design Air Flow	5.03	L/s.m²	0.99	CFM/ft²
Infiltration Rate	0.42	L/s.m²	0.08	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	1,802,367	
Peak Zone Sensible Load	1,145,136	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	53,272	
Total air circulation or Design air	5.03	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	21	°C	69.8	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	21	°C	69.8	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning — Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Medium Retail	**50,000 - 100,000 ft2**		**Inland North**
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	550	Lux	51.1	ft-candles
Floor Fraction (GLFF)	0.70			
Connected Load	15.7	W/m²	1.5	W/ft²

Occ. Period(Hrs./yr.)	4800
Unocc. Period(Hrs./yr.)	3960
Usage During Occupied Period	95%
Usage During Unoccupied Period	20%
Fixture Cleaning:	
Incidence of Practice	
Interval	years

					Total
Light Level (Lux)	450	500	700	1000	
% Distribution	20%	50%	30%	0%	100%
Weighted Average					**550**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			55.0%		45.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

Relamping Strategy & Incidence of Practice	Group	Spot

EUI	kWh/ft².yr	5.5
	MJ/m².yr	212

ARCHITECTURAL LIGHTING

Light Level	550	Lux	51.1	ft-candles
Floor Fraction (ALFF)	0.27			
Connected Load	60.8	W/m²	5.7	W/ft²

Occ. Period(Hrs./yr.)	4800
Unocc. Period(Hrs./yr.)	3960
Usage During Occupied Period	95%
Usage During Unoccupied Period	30%
Fixture Cleaning:	
Incidence of Practice	95%
Interval	20% years

					Total
Light Level (Lux)	450	500	700	1000	
% Distribution	20%	50%	30%	0%	100%
Weighted Average					**550**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	65%	35%					0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

Relamping Strategy & Incidence of Practice	Group	Spot

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	8.8
	MJ/m².yr	340

SPECIAL PURPOSE LIGHTING

Light Level	550.00	Lux	51.1	ft-candles
Floor Fraction (HBLFF)	0.03			
Connected Load	25.6	W/m²	2.4	W/ft²

Floor fraction check: should = 1.00 | 1.00

Occ. Period(Hrs./yr.)	4800
Unocc. Period(Hrs./yr.)	3960
Usage During Occupied Period	95%
Usage During Unoccupied Period	20%
Fixture Cleaning:	
Incidence of Practice	
Interval	years

					Total
Light Level (Lux)	450	500	700	1000	
% Distribution	20%	50%	30%	0%	100%
Weighted Average					**550**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)						100%		100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

Relamping Strategy & Incidence of Practice	Group	Spot

EUI	kWh/ft².yr	0.4
	MJ/m².yr	15

TOTAL LIGHTING

Overall LPD	27.44 W/m²	EUI TOTAL	kWh/ft².yr	14.6
	2.55 W/ft²		MJ/m².yr	567

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Servers		Plug Loads	
Measured Power (W/device)	55		51		100		200		217			
Density (device/occupant)	0.36046		0.36046		0.01		0.01		0.02			
Connected Load	0.8	W/m²	0.7	W/m²	0.0	W/m²	0.1	W/m²	0.5	W/m²	1.15	W/m²
	0.1	W/ft²	0.1	W/ft²	0.00	W/ft²	0.01	W/ft²	0.05	W/ft²	0.11	W/ft²
Diversity Occupied Period	90%		90%		90%		90%		100%		90%	
Diversity Unoccupied Period	50%		50%		50%		50%		100%		25%	
Operation Occ. Period (hrs./year)	2000		2000		2600		2600		2600		4100	
Operation Unocc. Period (hrs./year)	6760		6760		6160		6160		6160		4660	

Total end-use load (occupied period)	3.0	W/m²	0.3	W/ft²
Total end-use load (unocc. period)	1.6	W/m²	0.2	W/ft²

Usage during occupied period	100%
Usage during unoccupied period	54%

Computer Equipment	EUI	kWh/ft².yr	1.21
		MJ/m².yr	46.85
Plug Loads	EUI	kWh/ft².yr	0.52
		MJ/m².yr	20.10

FOOD SERVICE EQUIPMENT

Provide description below:

	Gas EUI		Electric EUI	
EUI	kWh/ft².yr	0.5	kWh/ft².yr	0.5
	MJ/m².yr	20.0	MJ/m².yr	20.0

REFRIGERATION

Provide description below:

EUI	kWh/ft².yr	0.2
	MJ/m².yr	8.6

MISCELLANEOUS

Provide description below:

	Gas EUI		Electric EUI	
EUI	kWh/ft².yr	0.3	kWh/ft².yr	0.0
	MJ/m².yr	10.0	MJ/m².yr	0.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Retail	50,000 - 100,000 ft2		Inland North
Baseline			

SPACE HEATING

Heating Plant Type

				Forced Air			Electric			Other	
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	District Heat	Total
System Present (%)	5%	2%	2%	55%	25%	0%	5%	1%	5%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff.) (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	57.8	W/m²	18.3	Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	381	MJ/m².yr	9.8	kWh/ft².yr
Sizing Factor	1.00			
Electric Fuel Share	11.0%	Fossil Fuel Share	89.0%	

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	7.4
MJ/m².yr	287

Gas EUI	
kWh/ft².yr	12.8
MJ/m².yr	497

Market Composite EUI	
kWh/ft².yr	12.2
MJ/m².yr	474

SPACE COOLING

A/C Plant Type

			WSHP			Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	10.0%	6.0%	0.0%	4.0%	80.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7	°C	44.6	°F
Condenser Water	30	°C	86	°F
Supply Air	14.0	°C	57.2	°F

Peak Cooling Load	70	W/m²	22	Btu/hr.ft²	537	ft²/Ton
Seasonal Cooling Load (Tertiary Load)	82.7	MJ/m².yr	2.1	kWh/ft².yr		

Sizing Factor 1.00 — Operation (occ. period) 3000 hrs/year Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C) 80.0%

Electric Fuel Share 100.0% — Gas Fuel Share 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	0.9
MJ/m².yr	34

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	0.9
MJ/m².yr	34

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	35%				10%
Eff./COP	0.65				0.75

	Fossil		Elec. Res.
Fuel Share	45%		55%
Blended Efficiency	0.67		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 35.0

Wetting Use Percentage 90%

All Electric EUI	
kWh/ft².yr	1.0
MJ/m².yr	38

Fossil Fuel EUI	
kWh/ft².yr	1.3
MJ/m².yr	52

Market Composite EUI	
kWh/ft².yr	1.2
MJ/m².yr	44.6

EXISTING BUILDINGS: **Medium Retail** **Baseline**
SIZE: **50,000 - 100,000 ft2**
VINTAGE:
REGION: **Inland North**

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	5.0	L/s.m²	0.99	CFM/ft²
System Static Pressure CAV	500	Pa	2.0	wg
System Static Pressure VAV	500	Pa	2.0	wg
Fan Efficiency	60%			
Fan Motor Efficiency	88%			
Sizing Factor	1.00			
Fan Design Load CAV	4.8	W/m²	0.44	W/ft²
Fan Design Load VAV	4.8	W/m²	0.44	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	100%	0%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	50%	50%	50%	50%
Comments:				

EXHAUST FANS

Washroom Exhaust	50	L/s.washroom	106	CFM/washroom
Washroom Exhaust per gross unit are	0.0	L/s.m²	0.00	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.1	L/s.m²	0.02	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.2	W/m²	0.01	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.020	kW/kW	0.07	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	1.41	W/m²	0.13	W/ft²

Condenser Pump

Pump Design Flow	0.000	L/s.KW	0.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.000	L/s.m²	0.000	U.S. gpm/ft²
Pump Head Pressure	45	kPa	15	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.00	W/m²	0.00	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.003	L/s.m²	0.0045	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	0	kPa	0	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.0	W/m²	0.00	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	29.2	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	0.9	kWh/m².yr
Condenser Pump Energy Consumption	0.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.4	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	0.0	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI	kWh/ft².yr	2.8
	MJ/m².yr	110.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Retail	50,000 - 100,000 ft2		Inland North
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	Electricity:	23.0 kWh/ft².yr	889.8 MJ/m².yr	Fossil Fuel	12.8 kWh/ft².yr	495.8 MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	5.5	212.2
ARCHITECTURAL LIGHTING	8.8	339.9
SPECIAL PURPOSE LIGHTING	0.4	14.8
OTHER PLUG LOADS	0.5	20.1
HVAC FANS & PUMPS	2.8	110.0
REFRIGERATION	0.2	8.6
COMPUTER EQUIPMENT	1.2	46.9
ELEVATORS	0.1	3.9
OUTDOOR LIGHTING	0.9	33.9

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.8	31.6	11.4	442.4
SPACE COOLING	0.7	26.8	0.0	0.0
DOMESTIC HOT WATER	0.5	21.2	0.6	23.4
FOOD SERVICE EQUIPMENT	0.5	20.0	0.5	20.0
MISCELLANEOUS	0.0	0.0	0.3	10.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Food Retail			Inland North
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.59	W/m².°C	0.10	Btu/hr.ft² . °F	Typical Building Size	4,000	m²	43,040	ft²
Roof U value (W/m².°C)	0.47	W/m².°C	0.08	Btu/hr.ft² . °F	Typical Footprint (m²)	4,000	m²	43,040	ft²
Glazing U value (W/m².°C)	4.03	W/m².°C	0.71	Btu/hr.ft² . °F	Footprint Aspect Ratio (L:W)	1			
					Percent Conditioned Space	100%			
					Percent Conditioned Space Defined as Exterior Zone	40%			
Window/Wall Ratio (WIWAR) (%)	0.06								
Shading Coefficient (SC)	0.69				Typical # Stories	1			
					Floor to Floor Height (m)	4.6	m	15.0	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	100%		0%		0%		0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	45	m²/person	484	ft²/person	%OA	27.43%
Occupancy Schedule Occ. Period	90%					
Occupancy Schedule Unocc. Period	0%					
Fresh Air Requirements or Outside Air	50	L/s.person	106	CFM/person		

Fresh Air Control Type *(enter a 1, 2 or 3) | 1 | If Fresh Air Control Type = "2" enter % FA. to the right: | 0%

(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air) | If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation | 0.5 L/s.m² | 0.10 CFM/ft² | 50% operation (%)

Sizing Factor	1.65			
Total Air Circulation or Design Air Flow	4.05	L/s.m²	0.80	CFM/ft²
Infiltration Rate	0.70	L/s.m²	0.14	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	1,339,363	
Peak Zone Sensible Load	447,287	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	20,808	
Total air circulation or Design air	4.05	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	22	°C	71.6	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	21	°C	69.8	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning | Changes/Year |

Incidence of Annual Room Controls Maintenance |

Incidence of Annual HVAC Controls Maintenance |

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: SIZE: VINTAGE: REGION:
Food Retail **Inland North**
Baseline

LIGHTING
GENERAL LIGHTING

Light Level	600 Lux	55.8	ft-candles
Floor Fraction (GLFF)	0.55		
Connected Load	16.7 W/m²	1.6	W/ft²
Occ. Period(Hrs./yr.)	4100		
Unocc. Period(Hrs./yr.)	4660		
Usage During Occupied Period	100%		
Usage During Unoccupied Period	40%		
Fixture Cleaning:			
Incidence of Practice			
Interval	years		
Relamping Strategy & Incidence of Practice	Group	Spot	

Light Level (Lux)	500	600	700	800				Total
% Distribution	25%	50%	25%	0%				100%
Weighted Average								**600**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			40.0%		60.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI kWh/ft².yr 5.1
MJ/m².yr 197

ARCHITECTURAL LIGHTING

Light Level	640 Lux	59.5	ft-candles
Floor Fraction (ALFF)	0.05		
Connected Load	80.6 W/m²	7.5	W/ft²
Occ. Period(Hrs./yr.)	4100		
Unocc. Period(Hrs./yr.)	4660		
Usage During Occupied Period	100%		
Usage During Unoccupied Period	50%		
Fixture Cleaning:			
Incidence of Practice			
Interval	years		
Relamping Strategy & Incidence of Practice	Group	Spot	

Light Level (Lux)	300	500	700	1000				Total
% Distribution	0%	30%	70%	0%				100%
Weighted Average								**640**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	80%	20%					0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI kWh/ft².yr 2.4
EUI = Load X Hrs. X SF X GLFF MJ/m².yr 93

SPECIAL PURPOSE LIGHTING

Light Level	620.00 Lux	57.6	ft-candles
Floor Fraction (HBLFF)	0.40		
Connected Load	28.9 W/m²	2.7	W/ft²
Occ. Period(Hrs./yr.)	4100		
Unocc. Period(Hrs./yr.)	4660		
Usage During Occupied Period	100%		
Usage During Unoccupied Period	50%		
Fixture Cleaning:			
Incidence of Practice			
Interval	years		
Relamping Strategy & Incidence of Practice	Group	Spot	

Floor fraction check: should = 1.00 1.00

Light Level (Lux)	300	500	700	1000				Total
% Distribution	0%	40%	60%	0%				100%
Weighted Average								**620**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)						100%		100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI kWh/ft².yr 6.9
MJ/m².yr 268

TOTAL LIGHTING Overall LPD 13.22 W/m² EUI TOTAL kWh/ft².yr 14.4
1.23 W/ft² MJ/m².yr 558

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Servers	Plug Loads
Measured Power (W/device)	55	51	100	200	217	
Density (device/occupant)	0.648828	0.648828	0.01	0.01	0.03	
Connected Load	0.8 W/m²	0.7 W/m²	0.0 W/m²	0.0 W/m²	0.5 W/m²	2.85 W/m²
	0.1 W/ft²	0.1 W/ft²	0.00 W/ft²	0.00 W/ft²	0.05 W/ft²	0.26 W/ft²
Diversity Occupied Period	90%	90%	90%	90%	100%	90%
Diversity Unoccupied Period	50%	50%	50%	50%	100%	50%
Operation Occ. Period (hrs./year)	2000	2000	2600	2600	2600	4100
Operation Unocc. Period (hrs./year)	6760	6760	6160	6160	6160	4660

Total end-use load (occupied period)	4.5 W/m²	0.4 W/ft²
Total end-use load (unocc. period)	2.7 W/m²	0.3 W/ft²
Usage during occupied period	100%	
Usage during unoccupied period	61%	

Computer Equipment EUI kWh/ft².yr 1.18
MJ/m².yr 45.81
Plug Loads EUI kWh/ft².yr 1.59
MJ/m².yr 61.77

FOOD SERVICE EQUIPMENT
Provide description below:

Gas EUI: EUI kWh/ft².yr 2.1; MJ/m².yr 80.0
Electric EUI: EUI kWh/ft².yr 1.5; MJ/m².yr 60.0

REFRIGERATION
Provide description below:
Commercial refrigeration display cases

EUI kWh/ft².yr 31.0
MJ/m².yr 1200.0

MISCELLANEOUS
Provide description below:

Gas EUI: EUI kWh/ft².yr 0.5; MJ/m².yr 20.0
Electric EUI: EUI kWh/ft².yr 1.5; MJ/m².yr 60.0

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Food Retail			Inland North
Baseline			

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	5%	2%	2%	56%	25%	0%	5%		5%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff.) (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load: 51.8 W/m² — 16.4 Btu/hr.ft²

Seasonal Heating Load (Tertiary Load): 639 MJ/m².yr — 16.5 kWh/ft².yr

Sizing Factor: 1.00

Electric Fuel Share: 10.0% — Fossil Fuel Share: 90.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	13.1
MJ/m².yr	508

Gas EUI	
kWh/ft².yr	21.5
MJ/m².yr	833

Market Composite EUI	
kWh/ft².yr	20.7
MJ/m².yr	801

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	0.0%	0.0%	0.0%	10.0%	90.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

	°C	°F
Chilled Water	7 °C	44.6 °F
Condenser Water	30 °C	86 °F
Supply Air	14.0 °C	57.2 °F

Peak Cooling Load: 98 W/m² — 31 Btu/hr.ft² — 386 ft²/Ton

Seasonal Cooling Load (Tertiary Load): 77.1 MJ/m².yr — 2.0 kWh/ft².yr

Sizing Factor: 1.00 — Operation (occ. period): 3000 hrs/year — Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C): 60.0%

Electric Fuel Share: 100.0% — Gas Fuel Share: 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	0.8
MJ/m².yr	31

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	0.8
MJ/m².yr	31

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	60%				5%
Eff./COP	0.65				0.75

	Fossil		Elec. Res.
Fuel Share	65%		35%
Blended Efficiency	0.66		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load): 70.0

Wetting Use Percentage: 90%

All Electric EUI	
kWh/ft².yr	2.0
MJ/m².yr	77

Fossil Fuel EUI	
kWh/ft².yr	2.7
MJ/m².yr	106

Market Composite EUI	
kWh/ft².yr	2.5
MJ/m².yr	96.1

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Food Retail			**Inland North**
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	4.1	L/s.m²	0.80	CFM/ft²
System Static Pressure CAV	500	Pa	2.0	wg
System Static Pressure VAV	1000	Pa	4.0	wg
Fan Efficiency	60%			
Fan Motor Efficiency	80%			
Sizing Factor	1.00			
Fan Design Load CAV	4.2	W/m²	0.39	W/ft²
Fan Design Load VAV	8.4	W/m²	0.78	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	100%	0%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	60%	40%	100%	0%
Comments:				

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m²	0.01	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.2	L/s.m²	0.03	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.2	W/m²	0.02	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.024	kW/kW	0.08	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	2.31	W/m²	0.21	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.005	L/s.m²	0.008	U.S. gpm/ft²
Pump Head Pressure	0	kPa	0	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.00	W/m²	0.00	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.004	L/s.m²	0.0062	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.8	W/m²	0.08	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	28.1	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	1.8	kWh/m².yr
Condenser Pump Energy Consumption	0.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.4	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	4.2	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI	kWh/ft².yr	3.2
	MJ/m².yr	124.2

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: Food Retail Baseline | **SIZE:** | **VINTAGE:** | **REGION:** Inland North

EUI SUMMARY

TOTAL ALL END-USES: **Electricity:** **58.4** kWh/ft².yr **2,261.2** MJ/m².yr **Fossil Fuel** **23.7** kWh/ft².yr **919.0** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	5.1	197.3
ARCHITECTURAL LIGHTING	2.4	93.3
SPECIAL PURPOSE LIGHTING	6.9	267.6
OTHER PLUG LOADS	1.6	61.8
HVAC FANS & PUMPS	3.2	124.2
REFRIGERATION	31.0	1,200.0
COMPUTER EQUIPMENT	1.2	45.8
ELEVATORS	0.1	3.9
OUTDOOR LIGHTING	1.3	50.9

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	1.3	50.8	19.4	749.8
SPACE COOLING	0.5	18.7	0.0	0.0
DOMESTIC HOT WATER	0.7	26.9	1.8	69.2
FOOD SERVICE EQUIPMENT	1.5	60.0	2.1	80.0
MISCELLANEOUS	1.5	60.0	0.5	20.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **SIZE:** **VINTAGE:** **REGION:**
Large Hotel **Inland North**
Baseline

CONSTRUCTION

Wall U value (W/m².°C)	0.55	W/m².°C	0.10	Btu/hr.ft² . °F	Typical Building Size	20,000 m²	215,200	ft²
Roof U value (W/m².°C)	0.41	W/m².°C	0.07	Btu/hr.ft² . °F	Typical Footprint (m²)	2,000 m²	21,520	ft²
Glazing U value (W/m².°C)	3.78	W/m².°C	0.67	Btu/hr.ft² . °F	Footprint Aspect Ratio (L:W)	3		
					Percent Conditioned Space	100%		
					Percent Conditioned Space Defined as Exterior Zone	45%		
Window/Wall Ratio (WIWAR) (%)	0.30							
Shading Coefficient (SC)	0.65				Typical # Stories	10		
					Floor to Floor Height (m)	3.7 m	12.0	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	80%		0%		20%		0%		100%
Min. Air Flow (%)					60%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	50	m²/person	538	ft²/person
Occupancy Schedule Occ. Period	50%			
Occupancy Schedule Unocc. Period	80%			
Fresh Air Requirements or Outside Air	55	L/s.person	117	CFM/person

%OA 19.21%

Fresh Air Control Type *(enter a 1, 2 or 3) 1
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right: 15%
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation 0.5 L/s.m² 0.10 CFM/ft²
50% operation (%)

Sizing Factor	2.25			
Total Air Circulation or Design Air Flow	5.73	L/s.m²	1.13	CFM/ft²
Infiltration Rate	0.70	L/s.m²	0.14	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	6,684,260	
Peak Zone Sensible Load	2,318,464	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	107,855	
Total air circulation or Design air	5.73	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	23	°C	73.4	°F	15	°C	59	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	20.8	°C	69.44	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Hotel			Inland North
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	290	Lux	27.0	ft-candles
Floor Fraction (GLFF)	0.25			
Connected Load	8.2	W/m²	0.8	W/ft²
Occ. Period(Hrs./yr.)	3000			
Unocc. Period(Hrs./yr.)	5760			
Usage During Occupied Period	85%			
Usage During Unoccupied Period	90%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	200	300	400	500				Total
% Distribution	50%	20%	20%	10%				100%
Weighted Average								**290**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			50.0%		50.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	1.5
	MJ/m².yr	57

ARCHITECTURAL LIGHTING

Light Level	220	Lux	20.4	ft-candles
Floor Fraction (ALFF)	0.75			
Connected Load	21.0	W/m²	1.9	W/ft²
Occ. Period(Hrs./yr.)	2500			
Unocc. Period(Hrs./yr.)	6260			
Usage During Occupied Period	60%			
Usage During Unoccupied Period	40%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	100	200	300	400				Total
% Distribution	20%	50%	20%	10%				100%
Weighted Average								**220**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	50%	50%					0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	5.8
	MJ/m².yr	227

SPECIAL PURPOSE LIGHTING

Light Level	0.00	Lux	0.0	ft-candles
Floor Fraction (HBLFF)	0.00			
Connected Load	0.0	W/m²	0.0	W/ft²
Occ. Period(Hrs./yr.)	4000			
Unocc. Period(Hrs./yr.)	4760			
Usage During Occupied Period	0%			
Usage During Unoccupied Period	100%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 | 1.00

Light Level (Lux)	300	500	700	1000				Total
% Distribution		0%	0%	0%				0%
Weighted Average								**0**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)								0.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	0.0
	MJ/m².yr	0

TOTAL LIGHTING

Overall LPD	17.77 W/m²	EUI TOTAL	kWh/ft².yr	7.3
	1.65 W/ft²		MJ/m².yr	284

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Servers	Plug Loads
Measured Power (W/device)	55	51	100	200	217	
Density (device/occupant)	0.3	0.3	0.05	0.033	0.03	
Connected Load	0.3 W/m²	0.3 W/m²	0.1 W/m²	0.1 W/m²	0.5 W/m²	2.1 W/m²
	0.0 W/ft²	0.0 W/ft²	0.01 W/ft²	0.01 W/ft²	0.05 W/ft²	0.20 W/ft²
Diversity Occupied Period	90%	90%	90%	90%	100%	70%
Diversity Unoccupied Period	50%	50%	50%	50%	100%	25%
Operation Occ. Period (hrs./year)	2500	2500	2500	2500	2500	3000
Operation Unocc. Period (hrs./year)	6260	6260	6260	6260	6260	5760

Total end-use load (occupied period)	2.8 W/m²	0.3 W/ft²
Total end-use load (unocc. period)	1.5 W/m²	0.1 W/ft²
Usage during occupied period	100%	
Usage during unoccupied period	53%	

Computer Equipment	EUI	kWh/ft².yr	0.85
		MJ/m².yr	32.93
Plug Loads	EUI	kWh/ft².yr	0.69
		MJ/m².yr	26.76

FOOD SERVICE EQUIPMENT

Provide description below:

Kitchen

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	2.6	EUI	kWh/ft².yr	0.5
	MJ/m².yr	100.0		MJ/m².yr	20.0

REFRIGERATION

Provide description below:

Walk-in coolers/freezers, reach-in coolers/freezers, refrigerated buffet cases

EUI	kWh/ft².yr	0.8
	MJ/m².yr	30.0

MISCELLANEOUS

Provide description below:

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	1.5	EUI	kWh/ft².yr	0.0
	MJ/m².yr	60.0		MJ/m².yr	0.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **Large Hotel** **Baseline** | **SIZE:** | **VINTAGE:** | **REGION:** **Inland North**

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	42%	20%	5%	18%	0%	0%	5%	2%	8%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff. (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load: 56.7 W/m² — 18.0 Btu/hr.ft²
Seasonal Heating Load (Tertiary Load): 473 MJ/m².yr — 12.2 kWh/ft².yr
Sizing Factor: 1.00

Electric Fuel Share: 15.0% — Fossil Fuel Share: 85.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	9.5
MJ/m².yr	366

Gas EUI	
kWh/ft².yr	15.9
MJ/m².yr	615

Market Composite EUI	
kWh/ft².yr	14.9
MJ/m².yr	578

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	45.0%	25.0%	0.0%	0.0%	30.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7	°C	44.6	°F
Condenser Water	30	°C	86	°F
Supply Air	15.0	°C	59	°F

Peak Cooling Load: 88 W/m² — 28 Btu/hr.ft² — 429 ft²/Ton
Seasonal Cooling Load (Tertiary Load): 118.5 MJ/m².yr — 3.1 kWh/ft².yr

Sizing Factor: 0.90 — Operation (occ. period): 3000 hrs/year — Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C): 80.0%

Electric Fuel Share: 100.0% — Gas Fuel Share: 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	1.2
MJ/m².yr	47

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	1.2
MJ/m².yr	47

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	20%				70%
Eff./COP	0.65				0.75

	Fossil		Elec. Res.
Fuel Share	90%		10%
Blended Efficiency	0.73		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load): 236.6

Wetting Use Percentage: 90%

All Electric EUI	
kWh/ft².yr	6.7
MJ/m².yr	260

Fossil Fuel EUI	
kWh/ft².yr	8.4
MJ/m².yr	325

Market Composite EUI	
kWh/ft².yr	8.2
MJ/m².yr	318.6

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Hotel			Inland North
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	5.7	L/s.m²	1.13	CFM/ft²
System Static Pressure CAV	500	Pa	2.0	wg
System Static Pressure VAV	750	Pa	3.0	wg
Fan Efficiency	55%			
Fan Motor Efficiency	80%			
Sizing Factor	1.00			
Fan Design Load CAV	6.5	W/m²	0.60	W/ft²
Fan Design Load VAV	9.8	W/m²	0.91	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	80%	20%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	50%	50%	100%	0%
Comments:				

EXHAUST FANS

Washroom Exhaust	550	L/s.washroom	1165	CFM/washroom
Washroom Exhaust per gross unit are	0.6	L/s.m²	0.11	CFM/ft²
Other Exhaust (Smoking/Conference)	0.5	L/s.m²	0.10	CFM/ft²
Total Building Exhaust	1.1	L/s.m²	0.21	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	50%			
Fan Motor Efficiency	80%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.7	W/m²	0.06	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.023	kW/kW	0.08	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	2.01	W/m²	0.19	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.005	L/s.m²	0.007	U.S. gpm/ft²
Pump Head Pressure	100	kPa	33.333333	ft
Pump Efficiency	55%			
Pump Motor Efficiency	85%			
Sizing Factor	1.0			
Pump Connected Load	1.00	W/m²	0.09	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.004	L/s.m²	0.0056	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	85%					
Sizing Factor	0.8					
Pump Connected Load	0.7	W/m²	0.07	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	40.0	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	5.7	kWh/m².yr
Condenser Pump Energy Consumption	2.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.7	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	3.6	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI		
	kWh/ft².yr	4.8
	MJ/m².yr	187.3

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Large Hotel			**Inland North**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**18.8** kWh/ft².yr	**727.4** MJ/m².yr	**Fossil Fue**	**25.2** kWh/ft².yr **975.6** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	1.5	57.2
ARCHITECTURAL LIGHTING	5.8	226.5
SPECIAL PURPOSE LIGHTING	0.0	0.0
OTHER PLUG LOADS	0.7	26.8
HVAC FANS & PUMPS	4.8	187.3
REFRIGERATION	0.8	30.0
COMPUTER EQUIPMENT	0.9	32.9
ELEVATORS	0.3	11.6
OUTDOOR LIGHTING	0.4	17.0

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	1.4	54.9	13.5	523.0
SPACE COOLING	1.0	37.2	0.0	0.0
DOMESTIC HOT WATER	0.7	26.0	7.6	292.6
FOOD SERVICE EQUIPMENT	0.5	20.0	2.6	100.0
MISCELLANEOUS	0.0	0.0	1.5	60.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Hotel	50,000 to 100,000 ft²		Inland North
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.82	W/m².°C	0.14	Btu/hr.ft² . °F
Roof U value (W/m².°C)	0.56	W/m².°C	0.10	Btu/hr.ft² . °F
Glazing U value (W/m².°C)	4.30	W/m².°C	0.76	Btu/hr.ft² . °F
Window/Wall Ratio (WIWAR) (%)	0.28			
Shading Coefficient (SC)	0.57			

Typical Building Size	6,000	m²	64,560	ft²
Typical Footprint (m²)	1,500	m²	16,140	ft²
Footprint Aspect Ratio (L:W)	4			
Percent Conditioned Space	100%			
Percent Conditioned Space Defined as Exterior Zone	45%			
Typical # Stories	4			
Floor to Floor Height (m)	3.7	m	12.0	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	90%		0%		10%		0%		100%
Min. Air Flow (%)					60%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	46	m²/person	495	ft²/person
Occupancy Schedule Occ. Period	50%			
Occupancy Schedule Unocc. Period	80%			
Fresh Air Requirements or Outside Air	20	L/s.person	42	CFM/person

%OA 11.45%

Fresh Air Control Type *(enter a 1, 2 or 3) 1
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right: 15%
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation 0.5 L/s.m² 0.10 CFM/ft²; 50% operation (%)

Sizing Factor	1.4			
Total Air Circulation or Design Air Flow	3.80	L/s.m²	0.75	CFM/ft²
Infiltration Rate	1.00	L/s.m²	0.20	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	1,269,791	
Peak Zone Sensible Load	741,524	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	34,496	
Total air circulation or Design air	3.80	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	22	°C	71.6	°F	13	°C	55.4	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	21	°C	69.8	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Medium Hotel	**50,000 to 100,000 ft²**		**Inland North**
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	125	Lux	11.6	ft-candles
Floor Fraction (GLFF)	0.20			
Connected Load	3.5	W/m²	0.3	W/ft²

Occ. Period(Hrs./yr.)	3400
Unocc. Period(Hrs./yr.)	5360
Usage During Occupied Period	95%
Usage During Unoccupied Period	40%

Light Level (Lux)	125	300	700	1000				Total
% Distribution	100%	0%	0%	0%				100%
Weighted Average								**125**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			50.0%		50.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

Fixture Cleaning:
Incidence of Practice
Interval years

Relamping Strategy & Incidence of Practice: Group | Spot

EUI	kWh/ft².yr	0.4
	MJ/m².yr	14

ARCHITECTURAL LIGHTING

Light Level	160	Lux	14.9	ft-candles
Floor Fraction (ALFF)	0.80			
Connected Load	16.9	W/m²	1.6	W/ft²

Occ. Period(Hrs./yr.)	2300
Unocc. Period(Hrs./yr.)	6460
Usage During Occupied Period	65%
Usage During Unoccupied Period	50%

Light Level (Lux)	100	125	150	300				Total
% Distribution	20%	40%	20%	20%				100%
Weighted Average								**160**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	60%	40%					0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

Fixture Cleaning:
Incidence of Practice
Interval years

Relamping Strategy & Incidence of Practice: Group | Spot

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	5.9
	MJ/m².yr	230

SPECIAL PURPOSE LIGHTING

Light Level	0.00	Lux	0.0	ft-candles
Floor Fraction (HBLFF)	0.00			
Connected Load	0.0	W/m²	0.0	W/ft²

Floor fraction check: should = 1.00 | 1.00

Occ. Period(Hrs./yr.)	4000
Unocc. Period(Hrs./yr.)	4760
Usage During Occupied Period	0%
Usage During Unoccupied Period	100%

Light Level (Lux)	300	500	700	1000				Total
% Distribution		0%	0%	0%				0%
Weighted Average								**0**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)								0.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

Fixture Cleaning:
Incidence of Practice
Interval years

Relamping Strategy & Incidence of Practice: Group | Spot

EUI	kWh/ft².yr	0.0
	MJ/m².yr	0

TOTAL LIGHTING

Overall LPD	14.21 W/m²	EUI TOTAL	kWh/ft².yr	6.3
	1.32 W/ft²		MJ/m².yr	243

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Servers		Plug Loads	
Measured Power (W/device)	55		51		100		200		217			
Density (device/occupant)	0.3		0.3		0.05		0.033		0.02			
Connected Load	0.4	W/m²	0.3	W/m²	0.1	W/m²	0.1	W/m²	0.5	W/m²	2.05	W/m²
	0.0	W/ft²	0.0	W/ft²	0.01	W/ft²	0.01	W/ft²	0.05	W/ft²	0.19	W/ft²
Diversity Occupied Period	90%		90%		90%		90%		100%		70%	
Diversity Unoccupied Period	50%		50%		50%		50%		100%		25%	
Operation Occ. Period (hrs./year)	2500		2500		2500		2500		2500		3000	
Operation Unocc. Period (hrs./year)	6260		6260		6260		6260		6260		5760	

Total end-use load (occupied period)	2.8	W/m²	0.3	W/ft²
Total end-use load (unocc. period)	1.5	W/m²	0.1	W/ft²

Usage during occupied period	100%
Usage during unoccupied period	54%

Computer Equipment	EUI	kWh/ft².yr	0.89
		MJ/m².yr	34.38
Plug Loads	EUI	kWh/ft².yr	0.67
		MJ/m².yr	26.13

FOOD SERVICE EQUIPMENT

Provide description below:

Kitchen services

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	1.5	EUI	kWh/ft².yr	0.5
	MJ/m².yr	60.0		MJ/m².yr	20.0

REFRIGERATION

Provide description below:

Walk-in coolers/freezers, reach-in coolers/freezers, refrigerated buffet cases

EUI	kWh/ft².yr	0.8
	MJ/m².yr	30.0

MISCELLANEOUS

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	1.5	EUI	kWh/ft².yr	0.0
	MJ/m².yr	60.0		MJ/m².yr	0.0

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **Medium Hotel** **Baseline**
SIZE: **50,000 to 100,000 ft²**
VINTAGE:
REGION: **Inland North**

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	15%	10%	5%	30%	0%	0%	2%		38%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff.) (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	89.5 W/m²	28.4 Btu/hr.ft²	
Seasonal Heating Load (Tertiary Load)	584 MJ/m².yr	15.1 kWh/ft².yr	
Sizing Factor	1.00		
Electric Fuel Share	40.0%	Fossil Fuel Share	60.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

	All Electric EUI	Gas EUI	Market Composite EUI
kWh/ft².yr	14.8	19.6	17.7
MJ/m².yr	572	760	685

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	0.0%	0.0%	15.0%	15.0%	70.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7 °C	44.6 °F
Condenser Water	30 °C	86 °F
Supply Air	13.0 °C	55.4 °F

Peak Cooling Load	53 W/m²	17 Btu/hr.ft²	718 ft²/Ton
Seasonal Cooling Load (Tertiary Load)	82.9 MJ/m².yr	2.1 kWh/ft².yr	

Sizing Factor 0.85 Operation (occ. period) 3000 hrs/year Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C) 50.0%

Electric Fuel Share 100.0% Gas Fuel Share 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

	All Electric EUI	Natural Gas EUI	Market Composite EUI
kWh/ft².yr	0.9	0.0	0.9
MJ/m².yr	35	0	35

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	40%				30%
Eff./COP	0.65				0.75

	Fossil	Elec. Res.
Fuel Share	70%	30%
Blended Efficiency	0.69	0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 236.6

Wetting Use Percentage 90%

	All Electric EUI	Fossil Fuel EUI	Market Composite EUI
kWh/ft².yr	6.7	8.8	8.2
MJ/m².yr	260	341	317.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **Medium Hotel** **Baseline**
SIZE: **50,000 to 100,000 ft²**
VINTAGE:
REGION: **Inland North**

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	3.8	L/s.m²	0.75	CFM/ft²
System Static Pressure CAV	337.5	Pa	1.4	wg
System Static Pressure VAV	531.25	Pa	2.1	wg
Fan Efficiency	45%			
Fan Motor Efficiency	80%			
Sizing Factor	1.00			
Fan Design Load CAV	3.6	W/m²	0.33	W/ft²
Fan Design Load VAV	5.6	W/m²	0.52	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	90%	10%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	50%	50%	100%	0%
Comments:				

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m²	0.03	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.2	L/s.m²	0.05	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.3	W/m²	0.03	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.027	kW/kW	0.09	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	1.42	W/m²	0.13	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.003	L/s.m²	0.004	U.S. gpm/ft²
Pump Head Pressure	0	kPa	0	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.00	W/m²	0.00	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.002	L/s.m²	0.0033	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.5	W/m²	0.04	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	22.0	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	2.7	kWh/m².yr
Condenser Pump Energy Consumption	0.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.6	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	2.3	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI	kWh/ft².yr	2.6
	MJ/m².yr	99.2

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: Medium Hotel
Baseline

SIZE: 50,000 to 100,000 ft²

VINTAGE:

REGION: Inland North

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**20.4**	kWh/ft².yr	**789.3**	MJ/m².yr	**Fossil Fue**	**21.0** kWh/ft².yr	**815.1** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	0.4	13.7
ARCHITECTURAL LIGHTING	5.9	229.7
SPECIAL PURPOSE LIGHTING	0.0	0.0
OTHER PLUG LOADS	0.7	26.1
HVAC FANS & PUMPS	2.6	99.2
REFRIGERATION	0.8	30.0
COMPUTER EQUIPMENT	0.9	34.4
ELEVATORS	0.3	11.6
OUTDOOR LIGHTING	0.0	0.0

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	5.9	228.9	11.8	456.1
SPACE COOLING	0.5	17.7	0.0	0.0
DOMESTIC HOT WATER	2.0	78.0	6.2	239.0
FOOD SERVICE EQUIPMENT	0.5	20.0	1.5	60.0
MISCELLANEOUS	0.0	0.0	1.5	60.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **SIZE:** **VINTAGE:** **REGION:**
Hospital **Inland North**
Baseline

CONSTRUCTION

Wall U value (W/m².°C)	0.67	W/m².°C	0.12	Btu/hr.ft² . °F	Typical Building Size	14,000	m²	150,640	ft²
Roof U value (W/m².°C)	0.58	W/m².°C	0.10	Btu/hr.ft² . °F	Typical Footprint (m²)	1,750	m²	18,830	ft²
Glazing U value (W/m².°C)	4.30	W/m².°C	0.76	Btu/hr.ft² . °F	Footprint Aspect Ratio (L:W)	2			
					Percent Conditioned Space	100%			
					Percent Conditioned Space Defined as Exterior Zone	45%			
Window/Wall Ratio (WIWAR) (%)	0.15								
Shading Coefficient (SC)	0.65				Typical # Stories	8			
					Floor to Floor Height (m)	4.3	m	14.0	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	50%		0%		50%		0%		100%
Min. Air Flow (%)					60%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	30	m²/person	323	ft²/person
Occupancy Schedule Occ. Period	90%			
Occupancy Schedule Unocc. Period	75%			
Fresh Air Requirements or Outside Air	75	L/s.person	159	CFM/person

%OA 43.48%

Fresh Air Control Type *(enter a 1, 2 or 3) 1
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right: 15%
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation 0.5 L/s.m² 0.10 CFM/ft²
50% operation (%)

Sizing Factor	2			
Total Air Circulation or Design Air Flow	5.75	L/s.m²	1.13	CFM/ft²
Infiltration Rate	0.70	L/s.m²	0.14	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	8,804,584	
Peak Zone Sensible Load	1,833,035	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	85,273	
Total air circulation or Design air	5.75	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	24	°C	75.2	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	23	°C	73.4	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	23	°C	73.4	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Hospital			Inland North
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	475	Lux	44.1	ft-candles
Floor Fraction (GLFF)	0.75			
Connected Load	13.1	W/m²	1.2	W/ft²
Occ. Period(Hrs./yr.)	3200			
Unocc. Period(Hrs./yr.)	5560			
Usage During Occupied Period	80%			
Usage During Unoccupied Period	35%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	100	250	700	800			Total
% Distribution		50%	50%	0%			100%
Weighted Average							**475**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			33.0%		67.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI		
	kWh/ft².yr	4.1
	MJ/m².yr	159

ARCHITECTURAL LIGHTING

Light Level	340	Lux	31.6	ft-candles
Floor Fraction (ALFF)	0.25			
Connected Load	32.4	W/m²	3.0	W/ft²
Occ. Period(Hrs./yr.)	2500			
Unocc. Period(Hrs./yr.)	6260			
Usage During Occupied Period	80%			
Usage During Unoccupied Period	35%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	100	250	700	800			Total
% Distribution		80%	20%	0%			100%
Weighted Average							**340**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	50%	50%						100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI		
	kWh/ft².yr	3.2
	MJ/m².yr	122

SPECIAL PURPOSE LIGHTING

Light Level	0.00	Lux	0.0	ft-candles
Floor Fraction (HBLFF)	0.00			
Connected Load	0.0	W/m²	0.0	W/ft²
Occ. Period(Hrs./yr.)	4000			
Unocc. Period(Hrs./yr.)	4760			
Usage During Occupied Period	0%			
Usage During Unoccupied Period	100%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 | 1.00

Light Level (Lux)	300	500	700	1000			Total
% Distribution		0%	0%	0%			0%
Weighted Average							**0**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)								0.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI		
	kWh/ft².yr	0.0
	MJ/m².yr	0

TOTAL LIGHTING

Overall LPD	17.89 W/m²	EUI TOTAL	kWh/ft².yr	7.3
	1.66 W/ft²		MJ/m².yr	281

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Servers	Plug Loads
Measured Power (W/device)	55	51	100	200	217	
Density (device/occupant)	0.477744	0.477744	0.02	0.02	0.04	
Connected Load	0.9 W/m²	0.8 W/m²	0.1 W/m²	0.1 W/m²	0.5 W/m²	3.85 W/m²
	0.1 W/ft²	0.1 W/ft²	0.01 W/ft²	0.01 W/ft²	0.05 W/ft²	0.36 W/ft²
Diversity Occupied Period	90%	90%	90%	90%	100%	90%
Diversity Unoccupied Period	50%	50%	50%	50%	100%	25%
Operation Occ. Period (hrs./year)	2000	2000	2600	2600	2600	4100
Operation Unocc. Period (hrs./year)	6760	6760	6160	6160	6160	4660

Total end-use load (occupied period)	5.7 W/m²	0.5 W/ft²
Total end-use load (unocc. period)	2.4 W/m²	0.2 W/ft²
Usage during occupied period	100%	
Usage during unoccupied period	43%	

Computer Equipment	EUI	kWh/ft².yr	1.33
		MJ/m².yr	51.37
Plug Loads	EUI	kWh/ft².yr	1.74
		MJ/m².yr	67.29

FOOD SERVICE EQUIPMENT

Provide description below:

Commercial food services

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	1.8	EUI	kWh/ft².yr	1.3
	MJ/m².yr	70.0		MJ/m².yr	50.0

REFRIGERATION

Provide description below:

Walk-in coolers/freezers, reach-in coolers/freezers, refrigerated buffet cases

EUI		
	kWh/ft².yr	0.4
	MJ/m².yr	15.0

MISCELLANEOUS

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	6.5	EUI	kWh/ft².yr	0.0
	MJ/m².yr	250.0		MJ/m².yr	

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Hospital			Inland North
Baseline			

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	10%	75%	0%	10%	0%	0%	1%	0%	4%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff.) (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	42.6	W/m²	13.5	Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	1949	MJ/m².yr	50.3	kWh/ft².yr
Sizing Factor	1.00			
Electric Fuel Share	5.0%	Fossil Fuel Share	95.0%	

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	kWh/ft².yr	46.2
	MJ/m².yr	1789
Gas EUI	kWh/ft².yr	63.8
	MJ/m².yr	2471
Market Composite EUI	kWh/ft².yr	62.9
	MJ/m².yr	2437

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	60.0%	20.0%	0.0%	15.0%	5.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7	°C	44.6	°F
Condenser Water	30	°C	86	°F
Supply Air	14.0	°C	57.2	°F

Peak Cooling Load	184	W/m²	58	Btu/hr.ft²	205	ft²/Ton
Seasonal Cooling Load (Tertiary Load)	97.6	MJ/m².yr	2.5	kWh/ft².yr		

Sizing Factor: 1.00 — Operation (occ. period): 3000 hrs/year — Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C): 85.0%

Electric Fuel Share: 100.0% — Gas Fuel Share: 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	kWh/ft².yr	1.4
	MJ/m².yr	53
Natural Gas EUI	kWh/ft².yr	0.0
	MJ/m².yr	0
Market Composite EUI	kWh/ft².yr	1.4
	MJ/m².yr	53

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	10%				80%
Eff./COP	0.65				0.80

	Fossil	Elec. Res.
Fuel Share	90%	10%
Blended Efficiency	0.78	0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load): 250.0

Wetting Use Percentage: 90%

	All Electric EUI	Fossil Fuel EUI	Market Composite EUI
kWh/ft².yr	7.1	8.2	8.1
MJ/m².yr	275	319	314.7

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EXISTING BUILDINGS: Hospital Baseline | **SIZE:** | **VINTAGE:** | **REGION:** Inland North

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	5.7	L/s.m²	1.13	CFM/ft²
System Static Pressure CAV	875	Pa	3.5	wg
System Static Pressure VAV	838	Pa	3.4	wg
Fan Efficiency	52%			
Fan Motor Efficiency	85%			
Sizing Factor	1.00			
Fan Design Load CAV	11.4	W/m²	1.06	W/ft²
Fan Design Load VAV	10.9	W/m²	1.01	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	50%	50%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	80%	20%	100%	0%

Comments:

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m²	0.02	CFM/ft²
Other Exhaust (Smoking/Conference)	0.5	L/s.m²	0.10	CFM/ft²
Total Building Exhaust	0.6	L/s.m²	0.12	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.8	W/m²	0.08	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.020	kW/kW	0.07	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	3.69	W/m²	0.34	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.010	L/s.m²	0.014	U.S. gpm/ft²
Pump Head Pressure	100	kPa	33.333333	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	2.44	W/m²	0.23	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.008	L/s.m²	0.0117	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	1.6	W/m²	0.15	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	72.0	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	7.2	kWh/m².yr
Condenser Pump Energy Consumption	3.4	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.5	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	7.9	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI		
	kWh/ft².yr	8.5
	MJ/m².yr	327.9

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **SIZE:** **VINTAGE:** **REGION:**
Hospital **Inland North**
Baseline

EUI SUMMARY

TOTAL ALL END-USES: **Electricity:** **25.8** kWh/ft².yr **1,000.5** MJ/m².yr **Fossil Fuel** **76.3** kWh/ft².yr **2,954.4** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	4.1	158.9
ARCHITECTURAL LIGHTING	3.2	122.1
SPECIAL PURPOSE LIGHTING	0.0	0.0
OTHER PLUG LOADS	1.7	67.3
HVAC FANS & PUMPS	8.5	327.9
REFRIGERATION	0.4	15.0
COMPUTER EQUIPMENT	1.3	51.4
ELEVATORS	0.3	11.6
OUTDOOR LIGHTING	0.9	33.9

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	2.3	89.4	60.6	2,347.2
SPACE COOLING	1.2	45.4	0.0	0.0
DOMESTIC HOT WATER	0.7	27.5	7.4	287.2
FOOD SERVICE EQUIPMENT	1.3	50.0	1.8	70.0
MISCELLANEOUS	0.0	0.0	6.5	250.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Nursing Home	**50,000 to 100,000 ft²**		**Inland North**
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.62	W/m².°C	0.11	Btu/hr.ft² . °F	Typical Building Size	5,600	m²	60,256	ft²
Roof U value (W/m².°C)	0.46	W/m².°C	0.08	Btu/hr.ft² . °F	Typical Footprint (m²)	2,800	m²	30,128	ft²
Glazing U value (W/m².°C)	3.78	W/m².°C	0.67	Btu/hr.ft² . °F	Footprint Aspect Ratio (L:W)	7			
					Percent Conditioned Space	100%			
					Percent Conditioned Space Defined as Exterior Zone	45%			
Window/Wall Ratio (WIWAR) (%)	0.28								
Shading Coefficient (SC)	0.60				Typical # Stories	2			
					Floor to Floor Height (m)	3.7	m	12.0	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	90%		0%		10%	0%	0%		100%
Min. Air Flow (%)					60%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	30	m²/person	323	ft²/person	%OA 31.13%
Occupancy Schedule Occ. Period	100%				
Occupancy Schedule Unocc. Period	95%				
Fresh Air Requirements or Outside Air	35	L/s.person	74	CFM/person	

Fresh Air Control Type *(enter a 1, 2 or 3) | 1 | If Fresh Air Control Type = "2" enter % FA. to the right: 15%
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air) | If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation | 0.5 L/s.m² | 0.10 CFM/ft² | 50% operation (%)

Sizing Factor	1.3			
Total Air Circulation or Design Air Flow	3.75	L/s.m²	0.74	CFM/ft²
Infiltration Rate	0.30	L/s.m²	0.06	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	2,064,246	
Peak Zone Sensible Load	735,283	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	34,205	
Total air circulation or Design air	3.75	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	23	°C	73.4	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	23	°C	73.4	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	23	°C	73.4	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Nursing Home	50,000 to 100,000 ft²		Inland North
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	267	Lux	24.8	ft-candles
Floor Fraction (GLFF)	0.70			
Connected Load	7.3	W/m²	0.7	W/ft²

Occ. Period(Hrs./yr.)	3400
Unocc. Period(Hrs./yr.)	5360
Usage During Occupied Period	95%
Usage During Unoccupied Period	20%
Fixture Cleaning:	
Incidence of Practice	
Interval	years
Relamping Strategy & Incidence of Practice	Group / Spot

Light Level (Lux)	200	300	500	1000			Total
% Distribution	33%	67%	0%	0%			100%
Weighted Average							**267**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			33.0%		67.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI		
	kWh/ft².yr	2.1
	MJ/m².yr	80

ARCHITECTURAL LIGHTING

Light Level	233	Lux	21.7	ft-candles
Floor Fraction (ALFF)	0.30			
Connected Load	24.6	W/m²	2.3	W/ft²

Occ. Period(Hrs./yr.)	3400
Unocc. Period(Hrs./yr.)	5360
Usage During Occupied Period	95%
Usage During Unoccupied Period	30%
Fixture Cleaning:	
Incidence of Practice	
Interval	years
Relamping Strategy & Incidence of Practice	Group / Spot

Light Level (Lux)	200	300	400	500			Total
% Distribution	67%	33%	0%	0%			100%
Weighted Average							**233**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	60%	40%					0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI		
	kWh/ft².yr	3.3
	MJ/m².yr	128

SPECIAL PURPOSE LIGHTING

Light Level	0.00	Lux	0.0	ft-candles
Floor Fraction (HBLFF)	0.00			
Connected Load	0.0	W/m²	0.0	W/ft²

Floor fraction check: should = 1.00 | 1.00

Occ. Period(Hrs./yr.)	4000
Unocc. Period(Hrs./yr.)	4760
Usage During Occupied Period	0%
Usage During Unoccupied Period	100%
Fixture Cleaning:	
Incidence of Practice	
Interval	years
Relamping Strategy & Incidence of Practice	Group / Spot

Light Level (Lux)	300	500	700	1000			Total
% Distribution		0%	0%	0%			0%
Weighted Average							**0**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)								0.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI		
	kWh/ft².yr	0.0
	MJ/m².yr	0

TOTAL LIGHTING

Overall LPD	12.51 W/m²	EUI TOTAL	kWh/ft².yr	5.4
	1.16 W/ft²		MJ/m².yr	208

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Servers	Plug Loads
Measured Power (W/device)	55	51	100	200	217	
Density (device/occupant)	0.477744	0.477744	0.02	0.02	0.04	
Connected Load	0.9 W/m²	0.8 W/m²	0.1 W/m²	0.1 W/m²	0.5 W/m²	1.35 W/m²
	0.1 W/ft²	0.1 W/ft²	0.01 W/ft²	0.01 W/ft²	0.05 W/ft²	0.13 W/ft²
Diversity Occupied Period	90%	90%	90%	90%	100%	90%
Diversity Unoccupied Period	50%	50%	50%	50%	100%	25%
Operation Occ. Period (hrs./year)	2000	2000	2600	2600	2600	4100
Operation Unocc. Period (hrs./year)	6760	6760	6160	6160	6160	4660

Total end-use load (occupied period)	3.4 W/m²	0.3 W/ft²
Total end-use load (unocc. period)	1.8 W/m²	0.2 W/ft²
Usage during occupied period	100%	
Usage during unoccupied period	52%	

Computer Equipment	EUI	kWh/ft².yr	1.33
		MJ/m².yr	51.37
Plug Loads	EUI	kWh/ft².yr	0.61
		MJ/m².yr	23.60

FOOD SERVICE EQUIPMENT

Provide description below:

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	1.5	EUI	kWh/ft².yr	1.3
	MJ/m².yr	60.0		MJ/m².yr	50.0

REFRIGERATION

Provide description below:

Walk-in coolers/freezers, reach-in coolers/freezers, refrigerated buffet cases

EUI		
	kWh/ft².yr	0.8
	MJ/m².yr	30.0

MISCELLANEOUS

Provide description below:

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	1.8	EUI	kWh/ft².yr	0.0
	MJ/m².yr	70.0		MJ/m².yr	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Nursing Home	50,000 to 100,000 ft²		Inland North
Baseline			

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	35%	35%	5%	10%	5%	0%	5%	0%	5%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff.) (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load: 54.7 W/m² — 17.3 Btu/hr.ft²

Seasonal Heating Load (Tertiary Load): 766 MJ/m².yr — 19.8 kWh/ft².yr

Sizing Factor: 1.00

Electric Fuel Share: 10.0% — Fossil Fuel Share: 90.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	15.7
MJ/m².yr	608

Gas EUI	
kWh/ft².yr	25.4
MJ/m².yr	983

Market Composite EUI	
kWh/ft².yr	24.4
MJ/m².yr	946

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	0.0%	0.0%	0.0%	15.0%	85.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7 °C	44.6 °F
Condenser Water	30 °C	86 °F
Supply Air	14.0 °C	57.2 °F

Peak Cooling Load: 92 W/m² — 29 Btu/hr.ft² — 412 ft²/Ton

Seasonal Cooling Load (Tertiary Load): 96.2 MJ/m².yr — 2.5 kWh/ft².yr

Sizing Factor: 0.85 — Operation (occ. period) 3000 hrs/year Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C): 30.0%

Electric Fuel Share: 100.0% — Gas Fuel Share: 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenan

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	1.1
MJ/m².yr	43

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	1.1
MJ/m².yr	43

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	10%				60%
Eff./COP	0.65				0.75

	Fossil		Elec. Res.
Fuel Share	70%		30%
Blended Efficiency	0.74		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load): 175.0

Wetting Use Percentage: 90%

All Electric EUI	
kWh/ft².yr	5.0
MJ/m².yr	192

Fossil Fuel EUI	
kWh/ft².yr	6.1
MJ/m².yr	238

Market Composite EUI	
kWh/ft².yr	5.8
MJ/m².yr	224.2

EXISTING BUILDINGS: Nursing Home Baseline | **SIZE:** 50,000 to 100,000 ft² | **VINTAGE:** | **REGION:** Inland North

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	3.7	L/s.m²	0.74	CFM/ft²
System Static Pressure CAV	500	Pa	2.0	wg
System Static Pressure VAV	500	Pa	2.0	wg
Fan Efficiency	52%			
Fan Motor Efficiency	75%			
Sizing Factor	1.00			
Fan Design Load CAV	4.8	W/m²	0.45	W/ft²
Fan Design Load VAV	4.8	W/m²	0.45	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	90%	10%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	80%	20%	100%	0%
Comments:				

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m²	0.01	CFM/ft²
Other Exhaust (Smoking/Conference)	0.5	L/s.m²	0.10	CFM/ft²
Total Building Exhaust	0.6	L/s.m²	0.11	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.8	W/m²	0.07	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.020	kW/kW	0.07	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	1.84	W/m²	0.17	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.005	L/s.m²	0.007	U.S. gpm/ft²
Pump Head Pressure	0	kPa	0	ft
Pump Efficiency	55%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.00	W/m²	0.00	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.004	L/s.m²	0.0058	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	55%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.7	W/m²	0.07	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	35.8	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	6.7	kWh/m².yr
Condenser Pump Energy Consumption	0.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.5	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	3.6	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI		
	kWh/ft².yr	4.3
	MJ/m².yr	167.8

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Nursing Home	50,000 to 100,000 ft²		Inland North
Baseline			

EUI SUMMARY

TOTAL ALL END-USES: **Electricity:** **18.3** kWh/ft².yr **707.8** MJ/m².yr **Fossil Fuel** **30.5** kWh/ft².yr **1,181.6** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	2.1	79.6
ARCHITECTURAL LIGHTING	3.3	128.4
SPECIAL PURPOSE LIGHTING	0.0	0.0
OTHER PLUG LOADS	0.6	23.6
HVAC FANS & PUMPS	4.3	167.8
REFRIGERATION	0.8	30.0
COMPUTER EQUIPMENT	1.3	51.4
ELEVATORS	0.3	11.6
OUTDOOR LIGHTING	0.9	33.9

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	1.6	60.8	22.9	885.1
SPACE COOLING	0.3	13.0	0.0	0.0
DOMESTIC HOT WATER	1.5	57.7	4.3	166.5
FOOD SERVICE EQUIPMENT	1.3	50.0	1.5	60.0
MISCELLANEOUS	0.0	0.0	1.8	70.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Schools	> 50,000 ft2		Inland North
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.64	W/m².°C	0.11	Btu/hr.ft² . °F	Typical Building Size	9,300 m²	100,068	ft²
Roof U value (W/m².°C)	0.51	W/m².°C	0.09	Btu/hr.ft² . °F	Typical Footprint (m²)	4,650 m²	50,034	ft²
Glazing U value (W/m².°C)	3.78	W/m².°C	0.67	Btu/hr.ft² . °F	Footprint Aspect Ratio (L:W)	5		
					Percent Conditioned Space	100%		
					Percent Conditioned Space Defined as Exterior Zone	37%		
Window/Wall Ratio (WIWAR) (%)	0.13							
Shading Coefficient (SC)	0.65				Typical # Stories	2		
					Floor to Floor Height (m)	4.0 m	13.2	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	90%		0%		10%		0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	10 m²/person	108 ft²/person	%OA	27.27%
Occupancy Schedule Occ. Period	90%			
Occupancy Schedule Unocc. Period	0%			
Fresh Air Requirements or Outside Air	9 L/s.person	19 CFM/person		

Fresh Air Control Type *(enter a 1, 2 or 3)	1	If Fresh Air Control Type = "2" enter % FA. to the right:	34%	
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)		If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation	0.5 L/s.m²	0.10 CFM/ft²
			50% operation (%)	

Sizing Factor	1.5			
Total Air Circulation or Design Air Flow	3.30 L/s.m²	0.65 CFM/ft²		
			Separate Make-up air unit (100% OA)	0 L/s.m² 0.00 CFM/ft²
Infiltration Rate	0.42 L/s.m²	0.08 CFM/ft²	Operation occupied period	50%
(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)			Operation unoccupied period	50%

Economizer

	Enthalpy Based		Dry-Bulb Based	Total
Incidence of Use	0%		100%	100%
Switchover Point		KJ/kg.	18 °C	
		Btu/lbm	64.4 °F	

Summary of Design Parameters		
Peak Design Cooling Load	2,786,874	
Peak Zone Sensible Load	931,855	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	43,350	
Total air circulation or Design air	3.30	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	23	°C	73.4	°F	13	°C	55.4	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	20.4	°C	68.72	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning — Changes/Year:

Incidence of Annual Room Controls Maintenance:

Incidence of Annual HVAC Controls Maintenance:

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Schools	> 50,000 ft2		Inland North
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	440	Lux	40.9	ft-candles
Floor Fraction (GLFF)	0.89			
Connected Load	12.1	W/m²	1.1	W/ft²
Occ. Period(Hrs./yr.)	3000			
Unocc. Period(Hrs./yr.)	5760			
Usage During Occupied Period	85%			
Usage During Unoccupied Period	25%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	300	500	700	1000				Total
% Distribution	40%	50%	10%	0%				100%
Weighted Average								**440**
	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			35.0%		65.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	4.0
	MJ/m².yr	155

ARCHITECTURAL LIGHTING

Light Level	400	Lux	37.2	ft-candles
Floor Fraction (ALFF)	0.01			
Connected Load	27.8	W/m²	2.6	W/ft²
Occ. Period(Hrs./yr.)	3000			
Unocc. Period(Hrs./yr.)	5760			
Usage During Occupied Period	90%			
Usage During Unoccupied Period	75%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	300	500	700	1000				Total
% Distribution	50%	50%	0%	0%				100%
Weighted Average								**400**
	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	25%	75%						100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	0.2
	MJ/m².yr	7

SPECIAL PURPOSE LIGHTING

Light Level	300.00	Lux	27.9	ft-candles
Floor Fraction (HBLFF)	0.10			
Connected Load	14.0	W/m²	1.3	W/ft²
Occ. Period(Hrs./yr.)	3000			
Unocc. Period(Hrs./yr.)	5760			
Usage During Occupied Period	100%			
Usage During Unoccupied Period	25%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 | 1.00

Light Level (Lux)	300	500	700	1000				Total
% Distribution	100%	0%	0%	0%				100%
Weighted Average								**300**
	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)						100%		100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	0.6
	MJ/m².yr	22

TOTAL LIGHTING

Overall LPD	12.48 W/m²	EUI TOTAL	kWh/ft².yr	4.8
	1.16 W/ft²		MJ/m².yr	185

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Servers	Plug Loads
Measured Power (W/device)	55	51	100	200	217	
Density (device/occupant)	0.222732	0.222732	0.02	0.02	0.01	
Connected Load	1.2 W/m²	1.1 W/m²	0.2 W/m²	0.4 W/m²	0.5 W/m²	0.25 W/m²
	0.1 W/ft²	0.1 W/ft²	0.02 W/ft²	0.04 W/ft²	0.05 W/ft²	0.02 W/ft²
Diversity Occupied Period	90%	90%	90%	90%	100%	100%
Diversity Unoccupied Period	25%	25%	25%	25%	100%	0%
Operation Occ. Period (hrs./year)	2000	2000	2000	2000	2600	3000
Operation Unocc. Period (hrs./year)	6760	6760	6760	6760	6160	5760

Total end-use load (occupied period)	3.4 W/m²	0.3 W/ft²
Total end-use load (unocc. period)	1.3 W/m²	0.1 W/ft²
Usage during occupied period	100%	
Usage during unoccupied period	37%	

Computer Equipment	EUI	kWh/ft².yr	1.37
		MJ/m².yr	53.21
Plug Loads	EUI	kWh/ft².yr	0.07
		MJ/m².yr	2.70

FOOD SERVICE EQUIPMENT

Provide description below:

Cafeteria

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	0.5	EUI	kWh/ft².yr	0.1
	MJ/m².yr	20.0		MJ/m².yr	5.0

REFRIGERATION

Provide description below:

EUI	kWh/ft².yr	0.1
	MJ/m².yr	2.1

MISCELLANEOUS

Provide description below:

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	0.1	EUI	kWh/ft².yr	0.0
	MJ/m².yr	5.0		MJ/m².yr	0.0

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Schools	> 50,000 ft2		Inland North
Baseline			

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	45%	20%	7%	10%	12%	0%	3%	0%	3%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff. (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	49.5	W/m²	15.7	Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	616	MJ/m².yr	15.9	kWh/ft².yr
Sizing Factor	1.00			
Electric Fuel Share	6.0%	Fossil Fuel Share	94.0%	

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	12.6
MJ/m².yr	489

Gas EUI	
kWh/ft².yr	20.5
MJ/m².yr	793

Market Composite EUI	
kWh/ft².yr	20.0
MJ/m².yr	775

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	0.0%	0.0%	0.0%	15.0%	85.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7	°C	44.6	°F
Condenser Water	30	°C	86	°F
Supply Air	13.0	°C	55.4	°F

Peak Cooling Load	88	W/m²	28	Btu/hr.ft²	431	ft²/Ton
Seasonal Cooling Load (Tertiary Load)	61.5	MJ/m².yr	1.6	kWh/ft².yr		

Sizing Factor: 1.00 — Operation (occ. period): 3000 hrs/year — Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C): 10.0%

Electric Fuel Share: 100.0% — Gas Fuel Share: 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	0.7
MJ/m².yr	27

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	0.7
MJ/m².yr	27

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	45%				25%
Eff./COP	0.65				0.75

	Fossil	Elec. Res.
Fuel Share	70%	30%
Blended Efficiency	0.69	0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load): 40.0

Wetting Use Percentage: 90%

All Electric EUI	
kWh/ft².yr	1.1
MJ/m².yr	44

Fossil Fuel EUI	
kWh/ft².yr	1.5
MJ/m².yr	58

Market Composite EUI	
kWh/ft².yr	1.4
MJ/m².yr	54.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Schools	> 50,000 ft2		Inland North
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	3.3	L/s.m²	0.65	CFM/ft²
System Static Pressure CAV	500	Pa	2.0	wg
System Static Pressure VAV	500	Pa	2.0	wg
Fan Efficiency	60%			
Fan Motor Efficiency	88%			
Sizing Factor	1.00			
Fan Design Load CAV	3.1	W/m²	0.29	W/ft²
Fan Design Load VAV	3.1	W/m²	0.29	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	90%	10%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	40%	60%	50%	50%
Comments:				

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.0	L/s.m²	0.01	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.1	L/s.m²	0.03	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.2	W/m²	0.02	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.020	kW/kW	0.07	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	1.76	W/m²	0.16	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.005	L/s.m²	0.007	U.S. gpm/ft²
Pump Head Pressure	0	kPa	0	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.00	W/m²	0.00	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.004	L/s.m²	0.0056	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.8	W/m²	0.07	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	16.8	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	1.2	kWh/m².yr
Condenser Pump Energy Consumption	0.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.3	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	3.8	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI	kWh/ft².yr	2.1
	MJ/m².yr	79.4

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Large Schools	**> 50,000 ft2**		**Inland North**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**10.1** kWh/ft².yr	**393.1** MJ/m².yr	**Fossil Fuel**	**20.9** kWh/ft².yr	**811.3** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	4.0	155.2
ARCHITECTURAL LIGHTING	0.2	7.0
SPECIAL PURPOSE LIGHTING	0.6	22.4
OTHER PLUG LOADS	0.1	2.7
HVAC FANS & PUMPS	2.1	79.4
REFRIGERATION	0.1	2.1
COMPUTER EQUIPMENT	1.4	53.2
ELEVATORS	0.1	3.9
OUTDOOR LIGHTING	0.4	17.0

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.8	29.3	19.2	745.4
SPACE COOLING	0.1	2.7	0.0	0.0
DOMESTIC HOT WATER	0.3	13.2	1.1	40.8
FOOD SERVICE EQUIPMENT	0.1	5.0	0.5	20.0
MISCELLANEOUS	0.0	0.0	0.1	5.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Medium Schools	**< 50,000 ft2**		**Inland North**
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.57	W/m².°C	0.10	Btu/hr.ft².°F	Typical Building Size	2,300	m²	24,748	ft²
Roof U value (W/m².°C)	0.48	W/m².°C	0.08	Btu/hr.ft².°F	Typical Footprint (m²)	2,300	m²	24,748	ft²
Glazing U value (W/m².°C)	3.78	W/m².°C	0.67	Btu/hr.ft².°F	Footprint Aspect Ratio (L:W)	5			
					Percent Conditioned Space	100%			
					Percent Conditioned Space Defined as Exterior Zone	50%			
Window/Wall Ratio (WIWAR) (%)	0.13								
Shading Coefficient (SC)	0.65				Typical # Stories	1			
					Floor to Floor Height (m)	4.0	m	13.2	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	100%		0%		0%		0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	10	m²/person	108	ft²/person	%OA	21.95%
Occupancy Schedule Occ. Period	90%					
Occupancy Schedule Unocc. Period	0%					
Fresh Air Requirements or Outside Air	8	L/s.person	16	CFM/person		

Fresh Air Control Type *(enter a 1, 2 or 3) | 1 | If Fresh Air Control Type = "2" enter % FA. to the right: | 34%

(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air) | If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation | 0.5 L/s.m² | 0.10 CFM/ft²

50% operation (%)

Sizing Factor	1.3			
Total Air Circulation or Design Air Flow	3.42	L/s.m²	0.67	CFM/ft²
Infiltration Rate	0.42	L/s.m²	0.08	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	666,457	
Peak Zone Sensible Load	275,352	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	12,809	
Total air circulation or Design air	3.42	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	21	°C	69.8	°F	13	°C	55.4	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	20.4	°C	68.72	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning — Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Schools	< 50,000 ft2		Inland North
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	400	Lux	37.2	ft-candles
Floor Fraction (GLFF)	0.89			
Connected Load	11.0	W/m²	1.0	W/ft²
Occ. Period(Hrs./yr.)	2400			
Unocc. Period(Hrs./yr.)	6360			
Usage During Occupied Period	85%			
Usage During Unoccupied Period	25%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	300	500	700	1000				Total
% Distribution	50%	50%	0%	0%				100%
Weighted Average								**400**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			35.0%		65.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	3.3
	MJ/m².yr	128

ARCHITECTURAL LIGHTING

Light Level	400	Lux	37.2	ft-candles
Floor Fraction (ALFF)	0.01			
Connected Load	27.8	W/m²	2.6	W/ft²
Occ. Period(Hrs./yr.)	2400			
Unocc. Period(Hrs./yr.)	6360			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	30%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	300	500	700	1000				Total
% Distribution	50%	50%	0%	0%				100%
Weighted Average								**400**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	25%	75%						100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	0.1
	MJ/m².yr	4

SPECIAL PURPOSE LIGHTING

Light Level	300.00	Lux	27.9	ft-candles
Floor Fraction (HBLFF)	0.10			
Connected Load	14.0	W/m²	1.3	W/ft²
Occ. Period(Hrs./yr.)	4000			
Unocc. Period(Hrs./yr.)	4760			
Usage During Occupied Period	100%			
Usage During Unoccupied Period	10%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 — 1.00

Light Level (Lux)	300	500	700	1000				Total
% Distribution	100%	0%	0%	0%				100%
Weighted Average								**300**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)						100%		100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	0.6
	MJ/m².yr	23

TOTAL LIGHTING

Overall LPD	10.10 W/m²	EUI TOTAL	kWh/ft².yr	4.0
	0.94 W/ft²		MJ/m².yr	155

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Servers		Plug Loads	
Measured Power (W/device)	55		51		100		200		217			
Density (device/occupant)	0.05		0.05		0.02		0.02		0.01			
Connected Load	0.3	W/m²	0.3	W/m²	0.2	W/m²	0.4	W/m²	0.5	W/m²	0.2	W/m²
	0.0	W/ft²	0.0	W/ft²	0.02	W/ft²	0.04	W/ft²	0.05	W/ft²	0.02	W/ft²
Diversity Occupied Period	90%		90%		90%		90%		100%		100%	
Diversity Unoccupied Period	25%		25%		25%		25%		100%		0%	
Operation Occ. Period (hrs./year)	2900		2900		2600		2600		2600		3000	
Operation Unocc. Period (hrs./year)	5860		5860		6160		6160		6160		5760	

Total end-use load (occupied period)	1.7	W/m²	0.2	W/ft²
Total end-use load (unocc. period)	0.8	W/m²	0.1	W/ft²
Usage during occupied period	100%			
Usage during unoccupied period	46%			

Computer Equipment	EUI	kWh/ft².yr	0.83
		MJ/m².yr	32.30
Plug Loads	EUI	kWh/ft².yr	0.06
		MJ/m².yr	2.16

FOOD SERVICE EQUIPMENT

Provide description below:

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	0.3	EUI	kWh/ft².yr	0.2
	MJ/m².yr	10.0		MJ/m².yr	8.0

REFRIGERATION

Provide description below:

EUI	kWh/ft².yr	0.0
	MJ/m².yr	1.1

MISCELLANEOUS

Provide description below:

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	0.1	EUI	kWh/ft².yr	1.2
	MJ/m².yr	5.0		MJ/m².yr	45.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Medium Schools	**< 50,000 ft2**		**Inland North**
Baseline			

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	45%	20%	7%	10%	12%	0%	3%	0%	3%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff. (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	61.2	W/m²	19.4	Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	556	MJ/m².yr	14.4	kWh/ft².yr
Sizing Factor	1.00			
Electric Fuel Share	6.0%	Fossil Fuel Share	94.0%	

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	11.4
MJ/m².yr	442

Gas EUI	
kWh/ft².yr	18.5
MJ/m².yr	717

Market Composite EUI	
kWh/ft².yr	18.1
MJ/m².yr	700

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7	°C	44.6	°F
Condenser Water	30	°C	86	°F
Supply Air	13.0	°C	55.4	°F

Peak Cooling Load	85	W/m²	27	Btu/hr.ft²	446	ft²/Ton
Seasonal Cooling Load (Tertiary Load)	68.4	MJ/m².yr	1.8	kWh/ft².yr		

Sizing Factor: 1.00 — Operation (occ. period): 3000 hrs/year — Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C): 10.0%

Electric Fuel Share: 100.0% — Gas Fuel Share: 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenan

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	0.8
MJ/m².yr	30

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	0.8
MJ/m².yr	30

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	45%				25%
Eff./COP	0.65				0.75

	Fossil		Elec. Res.
Fuel Share	70%		30%
Blended Efficiency	0.69		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load): 40.0

Wetting Use Percentage: 90%

All Electric EUI	
kWh/ft².yr	1.1
MJ/m².yr	44

Fossil Fuel EUI	
kWh/ft².yr	1.5
MJ/m².yr	58

Market Composite EUI	
kWh/ft².yr	1.4
MJ/m².yr	54.0

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Medium Schools	**< 50,000 ft2**		**Inland North**
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	3.4	L/s.m²	0.67	CFM/ft²
System Static Pressure CAV	250	Pa	1.0	wg
System Static Pressure VAV	250	Pa	1.0	wg
Fan Efficiency	60%			
Fan Motor Efficiency	88%			
Sizing Factor	1.00			
Fan Design Load CAV	1.6	W/m²	0.15	W/ft²
Fan Design Load VAV	1.6	W/m²	0.15	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	65%	35%	50%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	65%	35%	50%	50%
Comments:				

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m²	0.02	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.2	L/s.m²	0.04	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.2	W/m²	0.02	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.020	kW/kW	0.07	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	1.70	W/m²	0.16	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.004	L/s.m²	0.007	U.S. gpm/ft²
Pump Head Pressure	0	kPa	0	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.00	W/m²	0.00	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.004	L/s.m²	0.0054	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.7	W/m²	0.07	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	9.6	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	1.5	kWh/m².yr
Condenser Pump Energy Consumption	0.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.4	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	3.7	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI		
	kWh/ft².yr	1.4
	MJ/m².yr	54.5

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Medium Schools	**< 50,000 ft2**		**Inland North**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES: **Electricity:** **9.3** kWh/ft².yr **359.7** MJ/m².yr **Fossil Fue** **18.8** kWh/ft².yr **729.4** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	3.3	128.4
ARCHITECTURAL LIGHTING	0.1	4.2
SPECIAL PURPOSE LIGHTING	0.6	22.5
OTHER PLUG LOADS	0.1	2.2
HVAC FANS & PUMPS	1.4	54.5
REFRIGERATION	0.0	1.1
COMPUTER EQUIPMENT	0.8	32.3
ELEVATORS	0.1	1.9
OUTDOOR LIGHTING	0.4	17.0

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.7	26.5	17.4	673.5
SPACE COOLING	0.1	3.0	0.0	0.0
DOMESTIC HOT WATER	0.3	13.2	1.1	40.8
FOOD SERVICE EQUIPMENT	0.2	8.0	0.3	10.0
MISCELLANEOUS	1.2	45.0	0.1	5.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **SIZE:** **VINTAGE:** **REGION:**
University-Colleges **Inland North**
Baseline

CONSTRUCTION

Wall U value (W/m².°C)	0.75	W/m².°C	0.13	Btu/hr.ft² . °F	Typical Building Size	9,000 m²	96,840	ft²
Roof U value (W/m².°C)	0.61	W/m².°C	0.11	Btu/hr.ft² . °F	Typical Footprint (m²)	3,000 m²	32,280	ft²
Glazing U value (W/m².°C)	4.56	W/m².°C	0.80	Btu/hr.ft² . °F	Footprint Aspect Ratio (L:W)	7		
					Percent Conditioned Space	100%		
					Percent Conditioned Space Defined as Exterior Zone	50%		
Window/Wall Ratio (WIWAR) (%)	0.30							
Shading Coefficient (SC)	0.65				Typical # Stories	3		
					Floor to Floor Height (m)	3.7 m	12.0	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	70%		0%		30%		0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	14	m²/person	151	ft²/person	%OA	19.54%
Occupancy Schedule Occ. Period	90%					
Occupancy Schedule Unocc. Period	0%					
Fresh Air Requirements or Outside Air	15	L/s.person	32	CFM/person		

Fresh Air Control Type *(enter a 1, 2 or 3) | 1 | If Fresh Air Control Type = "2" enter % FA. to the right: | 34%
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air) | If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation | 0.5 L/s.m² | 0.10 CFM/ft² | 50% operation (%)

Sizing Factor	1.6			
Total Air Circulation or Design Air Flow	5.48	L/s.m²	1.08	CFM/ft²
Infiltration Rate	0.70	L/s.m²	0.14	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	3,443,655	
Peak Zone Sensible Load	1,404,894	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	65,356	
Total air circulation or Design air	5.48	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	24	°C	75.2	°F	13	°C	55.4	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	16	°C	60.8	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	20.4	°C	68.72	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
University-Colleges			**Inland North**
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	610	Lux	56.7	ft-candles
Floor Fraction (GLFF)	0.93			
Connected Load	16.8	W/m²	1.6	W/ft²
Occ. Period(Hrs./yr.)	4100			
Unocc. Period(Hrs./yr.)	4660			
Usage During Occupied Period	90%			
Usage During Unoccupied Period	20%			

Light Level (Lux)	300	500	700	1000	Total
% Distribution	10%	25%	65%	0%	100%
Weighted Average					**610**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			35.0%	0%	65.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

Fixture Cleaning:
Incidence of Practice
Interval years

Relamping Strategy & Incidence of Practice: Group | Spot

EUI	kWh/ft².yr	6.7
	MJ/m².yr	260

ARCHITECTURAL LIGHTING

Light Level	300	Lux	27.9	ft-candles
Floor Fraction (ALFF)	0.03			
Connected Load	28.6	W/m²	2.7	W/ft²
Occ. Period(Hrs./yr.)	4100			
Unocc. Period(Hrs./yr.)	4660			
Usage During Occupied Period	100%			
Usage During Unoccupied Period	50%			

Light Level (Lux)	300	500	700	1000	Total
% Distribution	100%	0%	0%	0%	100%
Weighted Average					**300**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	50%	50%					0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

Fixture Cleaning:
Incidence of Practice
Interval years

Relamping Strategy & Incidence of Practice: Group | Spot

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	0.5
	MJ/m².yr	20

SPECIAL PURPOSE LIGHTING

Light Level	640.00	Lux	59.5	ft-candles
Floor Fraction (HBLFF)	0.04			
Connected Load	29.8	W/m²	2.8	W/ft²
Occ. Period(Hrs./yr.)	4100			
Unocc. Period(Hrs./yr.)	4660			
Usage During Occupied Period	90%			
Usage During Unoccupied Period	20%			

Floor fraction check: should = 1.00 | 1.00

Light Level (Lux)	300	500	700	1000	Total
% Distribution	0%	30%	70%	0%	100%
Weighted Average					**640**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)						100%		100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

Fixture Cleaning:
Incidence of Practice
Interval years

Relamping Strategy & Incidence of Practice: Group | Spot

EUI	kWh/ft².yr	0.5
	MJ/m².yr	20

TOTAL LIGHTING

Overall LPD	16.51 W/m²	EUI TOTAL	kWh/ft².yr	7.7
	1.53 W/ft²		MJ/m².yr	300

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Servers		Plug Loads	
Measured Power (W/device)	55		51		100		200		217			
Density (device/occupant)	0.311825		0.311825		0.02		0.02		0.01			
Connected Load	1.2	W/m²	1.1	W/m²	0.1	W/m²	0.3	W/m²	0.5	W/m²	1.3	W/m²
	0.1	W/ft²	0.1	W/ft²	0.01	W/ft²	0.03	W/ft²	0.05	W/ft²	0.12	W/ft²
Diversity Occupied Period	90%		90%		90%		90%		100%		100%	
Diversity Unoccupied Period	50%		50%		50%		50%		100%		20%	
Operation Occ. Period (hrs./year)	2000		2000		2600		2600		2600		2000	
Operation Unocc. Period (hrs./year)	6760		6760		6160		6160		6160		6760	

Total end-use load (occupied period)	4.3	W/m²	0.4	W/ft²
Total end-use load (unocc. period)	2.2	W/m²	0.2	W/ft²

Usage during occupied period 100%
Usage during unoccupied period 50%

Computer Equipment	EUI	kWh/ft².yr	1.76
		MJ/m².yr	68.30
Plug Loads	EUI	kWh/ft².yr	0.40
		MJ/m².yr	15.69

FOOD SERVICE EQUIPMENT

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	1.0	EUI	kWh/ft².yr	0.3
	MJ/m².yr	40.0		MJ/m².yr	10.0

REFRIGERATION

Provide description below:

EUI	kWh/ft².yr	0.5
	MJ/m².yr	20.0

MISCELLANEOUS

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	1.8	EUI	kWh/ft².yr	0.0
	MJ/m².yr	70.0		MJ/m².yr	0.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: University-Colleges Baseline | **SIZE:** | **VINTAGE:** | **REGION:** Inland North

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	20%	60%	5%	10%	0%	0%	2%	0%	3%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff.) (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load: 78.4 W/m² — 24.9 Btu/hr.ft²
Seasonal Heating Load (Tertiary Load): 770 MJ/m².yr — 19.9 kWh/ft².yr
Sizing Factor: 1.00

Electric Fuel Share: 5.0% — Fossil Fuel Share: 95.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	16.6
MJ/m².yr	643

Gas EUI	
kWh/ft².yr	25.2
MJ/m².yr	977

Market Composite EUI	
kWh/ft².yr	24.8
MJ/m².yr	961

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	20.0%	5.0%	0.0%	0.0%	75.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

	°C	°F
Chilled Water	7	44.6
Condenser Water	30	86
Supply Air	13.0	55.4

Peak Cooling Load: 112 W/m² — 36 Btu/hr.ft² — 337 ft²/Ton
Seasonal Cooling Load (Tertiary Load): 123.6 MJ/m².yr — 3.2 kWh/ft².yr

Sizing Factor: 1.00 — Operation (occ. period): 3000 hrs/year — Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C): 10.0%

Electric Fuel Share: 100.0% — Gas Fuel Share: 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	1.4
MJ/m².yr	53

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	1.4
MJ/m².yr	53

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	10%				75%
Eff./COP	0.65				0.75

	Fossil	Elec. Res.
Fuel Share	85%	15%
Blended Efficiency	0.74	0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load): 65.0

Wetting Use Percentage: 90%

All Electric EUI	
kWh/ft².yr	1.8
MJ/m².yr	71

Fossil Fuel EUI	
kWh/ft².yr	2.3
MJ/m².yr	88

Market Composite EUI	
kWh/ft².yr	2.2
MJ/m².yr	85.6

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **SIZE:** **VINTAGE:** **REGION:**
University-Colleges **Inland North**
Baseline

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	5.5	L/s.m²	1.08	CFM/ft²
System Static Pressure CAV	1000	Pa	4.0	wg
System Static Pressure VAV	1000	Pa	4.0	wg
Fan Efficiency	60%			
Fan Motor Efficiency	80%			
Sizing Factor	1.00			
Fan Design Load CAV	11.4	W/m²	1.06	W/ft²
Fan Design Load VAV	11.4	W/m²	1.06	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	70%	30%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	50%	50%	100%	0%
Comments:				

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m²	0.01	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.2	L/s.m²	0.03	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.2	W/m²	0.02	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.027	kW/kW	0.09	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	3.03	W/m²	0.28	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.006	L/s.m²	0.009	U.S. gpm/ft²
Pump Head Pressure	0	kPa	0	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.00	W/m²	0.00	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.005	L/s.m²	0.0071	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	1.0	W/m²	0.09	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	61.5	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	1.9	kWh/m².yr
Condenser Pump Energy Consumption	0.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.9	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	4.8	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI	kWh/ft².yr	6.4
	MJ/m².yr	249.0

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: University-Colleges Baseline
SIZE:
VINTAGE:
REGION: Inland North

EUI SUMMARY

TOTAL ALL END-USES: **Electricity:** **19.1** kWh/ft².yr **739.9** MJ/m².yr **Fossil Fuel** **28.7** kWh/ft².yr **1,113.3** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	6.7	260.5
ARCHITECTURAL LIGHTING	0.5	19.8
SPECIAL PURPOSE LIGHTING	0.5	19.9
OTHER PLUG LOADS	0.4	15.7
HVAC FANS & PUMPS	6.4	249.0
REFRIGERATION	0.5	20.0
COMPUTER EQUIPMENT	1.8	68.3
ELEVATORS	0.3	11.6
OUTDOOR LIGHTING	0.4	17.0

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.8	32.2	24.0	928.4
SPACE COOLING	0.1	5.3	0.0	0.0
DOMESTIC HOT WATER	0.3	10.7	1.9	74.8
FOOD SERVICE EQUIPMENT	0.3	10.0	1.0	40.0
MISCELLANEOUS	0.0	0.0	1.8	70.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Restaurant			Inland North
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.59 W/m².°C	0.10 Btu/hr.ft² . °F	Typical Building Size	1,225 m²	13,181 ft²
Roof U value (W/m².°C)	0.53 W/m².°C	0.09 Btu/hr.ft² . °F	Typical Footprint (m²)	1,225 m²	13,181 ft²
Glazing U value (W/m².°C)	4.43 W/m².°C	0.78 Btu/hr.ft² . °F	Footprint Aspect Ratio (L:W)	1	
			Percent Conditioned Space	100%	
			Percent Conditioned Space Defined as Exterior Zone	40%	
Window/Wall Ratio (WIWAR) (%)	0.18				
Shading Coefficient (SC)	0.69		Typical # Stories	1	
			Floor to Floor Height (m)	4.6 m	15.0 ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	100%		0%		0%		0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	20 m²/person	215 ft²/person	%OA 28.22%
Occupancy Schedule Occ. Period	90%		
Occupancy Schedule Unocc. Period	0%		
Fresh Air Requirements or Outside Air	33 L/s.person	70 CFM/person	

Fresh Air Control Type *(enter a 1, 2 or 3) | 1 | If Fresh Air Control Type = "2" enter % FA. to the right: | 0%

(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air) | If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation | 0.5 L/s.m² | 0.10 CFM/ft² | 50% operation (%)

Sizing Factor	1.4	
Total Air Circulation or Design Air Flow	5.85 L/s.m²	1.15 CFM/ft²
Infiltration Rate	0.70 L/s.m²	0.14 CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0 L/s.m²	0.00 CFM/ft²
Operation occupied period	50%	
Operation unoccupied period	50%	

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	643,507	
Peak Zone Sensible Load	233,028	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	10,840	
Total air circulation or Design air	5.85	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	22	°C	71.6	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	21	°C	69.8	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning — Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Restaurant			**Inland North**
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	400 Lux	37.1	ft-candles
Floor Fraction (GLFF)	0.20		
Connected Load	11.7 W/m²	1.1	W/ft²
Occ. Period(Hrs./yr.)	3400		
Unocc. Period(Hrs./yr.)	5360		
Usage During Occupied Period	95%		
Usage During Unoccupied Period	20%		
Fixture Cleaning:			
Incidence of Practice			
Interval	years		
Relamping Strategy & Incidence of Practice	Group	Spot	

Light Level (Lux)	300	400	500	1000	Total
% Distribution	33%	33%	33%	0%	100%
Weighted Average					**399.6**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			66.0%	0%	34.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	0.9
	MJ/m².yr	36

ARCHITECTURAL LIGHTING

Light Level	250 Lux	23.2	ft-candles
Floor Fraction (ALFF)	0.80		
Connected Load	32.8 W/m²	3.0	W/ft²
Occ. Period(Hrs./yr.)	3400		
Unocc. Period(Hrs./yr.)	5360		
Usage During Occupied Period	95%		
Usage During Unoccupied Period	30%		
Fixture Cleaning:			
Incidence of Practice			
Interval	years		
Relamping Strategy & Incidence of Practice	Group	Spot	

Light Level (Lux)	100	200	300	400	Total
% Distribution	10%	40%	40%	10%	100%
Weighted Average					**250**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	85%	15%					0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	11.8
	MJ/m².yr	457

SPECIAL PURPOSE LIGHTING

Light Level	0.00 Lux	0.0	ft-candles
Floor Fraction (HBLFF)	0.00		
Connected Load	0.0 W/m²	0.0	W/ft²
Occ. Period(Hrs./yr.)	4000		
Unocc. Period(Hrs./yr.)	4760		
Usage During Occupied Period	0%		
Usage During Unoccupied Period	100%		
Fixture Cleaning:			
Incidence of Practice			
Interval	years		
Relamping Strategy & Incidence of Practice	Group	Spot	

Floor fraction check: should = 1.00 — 1.00

Light Level (Lux)	300	500	700	1000	Total
% Distribution		0%	0%	0%	0%
Weighted Average					**0**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)								0.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	0.0
	MJ/m².yr	0

TOTAL LIGHTING

Overall LPD	28.56 W/m²	EUI TOTAL	kWh/ft².yr	12.7
	2.65 W/ft²		MJ/m².yr	493

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Servers	Plug Loads
Measured Power (W/device)	55	51	100	200	217	
Density (device/occupant)	0.1614	0.1614	0.01	0.01	0.01	
Connected Load	0.4 W/m²	0.4 W/m²	0.1 W/m²	0.1 W/m²	0.5 W/m²	3.2 W/m²
	0.0 W/ft²	0.0 W/ft²	0.00 W/ft²	0.01 W/ft²	0.05 W/ft²	0.30 W/ft²
Diversity Occupied Period	90%	90%	90%	90%	100%	90%
Diversity Unoccupied Period	50%	50%	50%	50%	100%	90%
Operation Occ. Period (hrs./year)	2000	2000	2600	2600	2600	4100
Operation Unocc. Period (hrs./year)	6760	6760	6160	6160	6160	4660

Total end-use load (occupied period)	4.3 W/m²	0.4 W/ft²
Total end-use load (unocc. period)	3.9 W/m²	0.4 W/ft²
Usage during occupied period	100%	
Usage during unoccupied period	91%	

Computer Equipment	EUI	kWh/ft².yr	0.90
		MJ/m².yr	34.97
Plug Loads	EUI	kWh/ft².yr	2.34
		MJ/m².yr	90.82

FOOD SERVICE EQUIPMENT

Provide description below:

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	23.2	EUI	kWh/ft².yr	8.5
	MJ/m².yr	900.0		MJ/m².yr	330.0

REFRIGERATION

Provide description below:

EUI	kWh/ft².yr	16.8
	MJ/m².yr	650.0

MISCELLANEOUS

Provide description below:

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	0.5	EUI	kWh/ft².yr	0.0
	MJ/m².yr	20.0		MJ/m².yr	0.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **Restaurant** **Baseline** | **SIZE:** | **VINTAGE:** | **REGION:** **Inland North**

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	2%	1%	1%	48%	35%	0%	1%	2%	10%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff. (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load: 75.3 W/m² | 23.9 Btu/hr.ft²
Seasonal Heating Load (Tertiary Load): 1205 MJ/m².yr | 31.1 kWh/ft².yr
Sizing Factor: 1.00

Electric Fuel Share: 13.0% | Fossil Fuel Share: 87.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	26.9
MJ/m².yr	1043

Gas EUI	
kWh/ft².yr	40.3
MJ/m².yr	1562

Market Composite EUI	
kWh/ft².yr	38.6
MJ/m².yr	1494

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	0.0%	0.0%	0.0%	10.0%	90.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

	°C	°F
Chilled Water	7	44.6
Condenser Water	30	86
Supply Air	14.0	57.2

Peak Cooling Load: 185 W/m² | 59 Btu/hr.ft² | 205 ft²/Ton
Seasonal Cooling Load (Tertiary Load): 121.4 MJ/m².yr | 3.1 kWh/ft².yr

Sizing Factor: 1.20 | Operation (occ. period): 3000 hrs/year Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C): 70.0%

Electric Fuel Share: 100.0% | Gas Fuel Share: 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenan

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	1.4
MJ/m².yr	55

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	1.4
MJ/m².yr	55

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	30%				30%
Eff./COP	0.65				0.75

	Fossil		Elec. Res.
Fuel Share	60%		40%
Blended Efficiency	0.70		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load): 600.0

Wetting Use Percentage: 10%

All Electric EUI	
kWh/ft².yr	17.0
MJ/m².yr	659

Fossil Fuel EUI	
kWh/ft².yr	22.1
MJ/m².yr	857

Market Composite EUI	
kWh/ft².yr	20.1
MJ/m².yr	778.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Restaurant			Inland North
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	5.8	L/s.m²	1.15	CFM/ft²
System Static Pressure CAV	500	Pa	2.0	wg
System Static Pressure VAV	500	Pa	2.0	wg
Fan Efficiency	60%			
Fan Motor Efficiency	80%			
Sizing Factor	1.00			
Fan Design Load CAV	6.1	W/m²	0.57	W/ft²
Fan Design Load VAV	6.1	W/m²	0.57	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	100%	0%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	80%	20%	100%	0%
Comments:				

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.2	L/s.m²	0.03	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.3	L/s.m²	0.05	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.4	W/m²	0.03	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.020	kW/kW	0.07	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	3.69	W/m²	0.34	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.010	L/s.m²	0.014	U.S. gpm/ft²
Pump Head Pressure	0	kPa	0	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.00	W/m²	0.00	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.008	L/s.m²	0.0117	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	0	kPa	0	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.0	W/m²	0.00	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	46.9	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	3.1	kWh/m².yr
Condenser Pump Energy Consumption	0.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.7	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	0.0	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI		
	kWh/ft².yr	4.7
	MJ/m².yr	182.4

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Restaurant			**Inland North**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**61.1** kWh/ft².yr	**2,367.1** MJ/m².yr	**Fossil Fue**	**72.1** kWh/ft².yr	**2,792.9** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	0.9	36.1
ARCHITECTURAL LIGHTING	11.8	456.8
SPECIAL PURPOSE LIGHTING	0.0	0.0
OTHER PLUG LOADS	2.3	90.8
HVAC FANS & PUMPS	4.7	182.4
REFRIGERATION	16.8	650.0
COMPUTER EQUIPMENT	0.9	35.0
ELEVATORS	0.1	1.9
OUTDOOR LIGHTING	3.8	145.9

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	3.5	135.6	35.1	1,358.6
SPACE COOLING	1.0	38.8	0.0	0.0
DOMESTIC HOT WATER	6.8	263.7	13.3	514.3
FOOD SERVICE EQUIPMENT	8.5	330.0	23.2	900.0
MISCELLANEOUS	0.0	0.0	0.5	20.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Warehouse/Whsale	0		Inland North
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.65	W/m². °C	0.11	Btu/hr.ft² . °F	Typical Building Size	3,200	m²	34,432	ft²
Roof U value (W/m².°C)	0.54	W/m². °C	0.09	Btu/hr.ft² . °F	Typical Footprint (m²)	3,200	m²	34,432	ft²
Glazing U value (W/m².°C)	4.10	W/m². °C	0.72	Btu/hr.ft² . °F	Footprint Aspect Ratio (L:W)	1			
					Percent Conditioned Space	100%			
					Percent Conditioned Space Defined as Exterior Zone	40%			
Window/Wall Ratio (WIWAR) (%)	0.05								
Shading Coefficient (SC)	0.80				Typical # Stories	1			
					Floor to Floor Height (m)	6.1	m	19.9	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	100%		0%		0%		0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	100	m²/person	1076	ft²/person	%OA 17.71%
Occupancy Schedule Occ. Period	90%				
Occupancy Schedule Unocc. Period	0%				
Fresh Air Requirements or Outside Air	50	L/s.person	106	CFM/person	

Fresh Air Control Type *(enter a 1, 2 or 3) | 1 | If Fresh Air Control Type = "2" enter % FA. to the right: | 0%

(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air) | If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation | 0.5 L/s.m² | 0.10 CFM/ft² | 50% operation (%)

Sizing Factor	1.6			
Total Air Circulation or Design Air Flow	2.82	L/s.m²	0.56	CFM/ft²
Infiltration Rate	0.70	L/s.m²	0.14	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0 L/s.m²	0.00 CFM/ft²
Operation occupied period	50%	
Operation unoccupied period	50%	

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	578,290	
Peak Zone Sensible Load	257,143	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	11,962	
Total air circulation or Design air	2.82	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	22	°C	71.6	°F	13	°C	55.4	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	16	°C	60.8	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	20.25	°C	68.45	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Warehouse/Whsale	0		Inland North
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	500	Lux	46.5	ft-candles
Floor Fraction (GLFF)	0.33			
Connected Load	14.6	W/m²	1.4	W/ft²
Occ. Period(Hrs./yr.)	3500			
Unocc. Period(Hrs./yr.)	5260			
Usage During Occupied Period	100%			
Usage During Unoccupied Period	25%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	300	500	700	1000	Total
% Distribution	0%	100%	0%	0%	100%
Weighted Average					**500**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			65.0%	0%	35.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	2.1
	MJ/m².yr	83

ARCHITECTURAL LIGHTING

Light Level	500	Lux	46.5	ft-candles
Floor Fraction (ALFF)	0.02			
Connected Load	55.3	W/m²	5.1	W/ft²
Occ. Period(Hrs./yr.)	2500			
Unocc. Period(Hrs./yr.)	6260			
Usage During Occupied Period	100%			
Usage During Unoccupied Period	50%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	300	500	700	1000	Total
% Distribution	0%	100%	0%	0%	100%
Weighted Average					**500**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	65%	35%					0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	0.6
	MJ/m².yr	22

SPECIAL PURPOSE LIGHTING

Light Level	420.00	Lux	39.0	ft-candles
Floor Fraction (HBLFF)	0.65			
Connected Load	16.3	W/m²	1.5	W/ft²
Occ. Period(Hrs./yr.)	3500			
Unocc. Period(Hrs./yr.)	5260			
Usage During Occupied Period	100%			
Usage During Unoccupied Period	25%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 | 1.00

Light Level (Lux)	300	500	700	1000	Total
% Distribution	40%	60%	0%	0%	100%
Weighted Average					**420**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)						80%	20%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.7	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	4.7
	MJ/m².yr	183

TOTAL LIGHTING

Overall LPD	16.47 W/m²	EUI TOTAL	kWh/ft².yr	7.5
	1.53 W/ft²		MJ/m².yr	289

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Servers	Plug Loads
Measured Power (W/device)	55	51	100	200	217	
Density (device/occupant)	0.5918	0.5918	0.03	0.03	0.06	
Connected Load	0.3 W/m²	0.3 W/m²	0.0 W/m²	0.1 W/m²	0.5 W/m²	2.5 W/m²
	0.0 W/ft²	0.0 W/ft²	0.00 W/ft²	0.01 W/ft²	0.05 W/ft²	0.23 W/ft²
Diversity Occupied Period	90%	90%	90%	90%	100%	90%
Diversity Unoccupied Period	50%	50%	50%	50%	100%	25%
Operation Occ. Period (hrs./year)	2000	2000	2600	2600	2600	4100
Operation Unocc. Period (hrs./year)	6760	6760	6160	6160	6160	4660

Total end-use load (occupied period)	3.4 W/m²	0.3 W/ft²
Total end-use load (unocc. period)	1.5 W/m²	0.1 W/ft²
Usage during occupied period	100%	
Usage during unoccupied period	44%	

Computer Equipment	EUI	kWh/ft².yr	0.76
		MJ/m².yr	29.58
Plug Loads	EUI	kWh/ft².yr	1.13
		MJ/m².yr	43.70

FOOD SERVICE EQUIPMENT

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	0.1	EUI	kWh/ft².yr	0.1
	MJ/m².yr	5.0		MJ/m².yr	4.0

REFRIGERATION

Provide description below:

Walk-in coolers

EUI	kWh/ft².yr	0.6
	MJ/m².yr	25.0

MISCELLANEOUS

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	0.5	EUI	kWh/ft².yr	0.0
	MJ/m².yr	20.0		MJ/m².yr	0.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Warehouse/Whsale	**0**		**Inland North**
Baseline			

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						Gas	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Radiant	
System Present (%)	4%	3%	1%	35%	5%	27%		2%	10%	13%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	75%	1.70	3.00	100%	75%	
Performance (1 / Eff.) (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.33	0.59	0.33	1.00	1.33	

Peak Heating Load	54.9 W/m²	17.4 Btu/hr.ft²	
Seasonal Heating Load (Tertiary Load)	458 MJ/m².yr	11.8 kWh/ft².yr	
Sizing Factor	1.00		
Electric Fuel Share	12.0%	Fossil Fuel Share	88.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	10.5
MJ/m².yr	407

Gas EUI	
kWh/ft².yr	15.6
MJ/m².yr	605

Market Composite EUI	
kWh/ft².yr	15.0
MJ/m².yr	582

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	0.0%	0.0%	0.0%	2.0%	98.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7 °C	44.6 °F
Condenser Water	30 °C	86 °F
Supply Air	13.0 °C	55.4 °F

Peak Cooling Load	53 W/m²	17 Btu/hr.ft²	714 ft²/Ton
Seasonal Cooling Load (Tertiary Load)	40.9 MJ/m².yr	1.1 kWh/ft².yr	

Sizing Factor 1.00 — Operation (occ. period) 3000 hrs/year — Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C) 30.0%

Electric Fuel Share 100.0% — Gas Fuel Share 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	0.4
MJ/m².yr	17

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	0.4
MJ/m².yr	17

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	47%				3%
Eff./COP	0.65				0.75

	Fossil	Elec. Res.
Fuel Share	50%	50%
Blended Efficiency	0.66	0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 25.0

Wetting Use Percentage 90%

All Electric EUI	
kWh/ft².yr	0.7
MJ/m².yr	27

Fossil Fuel EUI	
kWh/ft².yr	1.0
MJ/m².yr	38

Market Composite EUI	
kWh/ft².yr	0.8
MJ/m².yr	32.8

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Warehouse/Whsale	0		Inland North
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	2.8	L/s.m²	0.56	CFM/ft²
System Static Pressure CAV	425	Pa	1.7	wg
System Static Pressure VAV	425	Pa	1.7	wg
Fan Efficiency	60%			
Fan Motor Efficiency	80%			
Sizing Factor	1.00			
Fan Design Load CAV	2.5	W/m²	0.23	W/ft²
Fan Design Load VAV	2.5	W/m²	0.23	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	100%	0%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	80%	20%	100%	0%
Comments:				

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m²	0.01	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.2	L/s.m²	0.03	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.2	W/m²	0.02	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.020	kW/kW	0.07	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	1.06	W/m²	0.10	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.003	L/s.m²	0.004	U.S. gpm/ft²
Pump Head Pressure	0	kPa	0	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.00	W/m²	0.00	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.002	L/s.m²	0.0034	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	50	kPa	17	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.2	W/m²	0.02	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	19.3	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	1.9	kWh/m².yr
Condenser Pump Energy Consumption	0.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.2	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	1.0	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI	kWh/ft².yr	2.1
	MJ/m².yr	80.5

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Warehouse/Whsale	0		Inland North
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	Electricity:	14.5	kWh/ft².yr	560.1	MJ/m².yr	Fossil Fuel	14.9	kWh/ft².yr	576.9	MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	2.1	83.2
ARCHITECTURAL LIGHTING	0.6	22.4
SPECIAL PURPOSE LIGHTING	4.7	183.1
OTHER PLUG LOADS	1.1	43.7
HVAC FANS & PUMPS	2.1	80.5
REFRIGERATION	0.6	25.0
COMPUTER EQUIPMENT	0.8	29.6
ELEVATORS	0.1	3.9
OUTDOOR LIGHTING	0.4	17.0

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	1.3	48.9	13.8	532.8
SPACE COOLING	0.1	5.1	0.0	0.0
DOMESTIC HOT WATER	0.4	13.7	0.5	19.1
FOOD SERVICE EQUIPMENT	0.1	4.0	0.1	5.0
MISCELLANEOUS	0.0	0.0	0.5	20.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large High Rise	> 9,300 m² (100,000 ft²)		Inland North
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.68	W/m².°C	0.12	Btu/hr.ft² . °F
Roof U value (W/m².°C)	0.54	W/m².°C	0.09	Btu/hr.ft² . °F
Glazing U value (W/m².°C)	3.74	W/m².°C	0.66	Btu/hr.ft² . °F
Window/Wall Ratio (WIWAR) (%)	0.25			
Shading Coefficient (SC)	0.65			

Typical Building Size	21,365	m²	229,887	ft²
Typical Footprint (m²)	1,125	m²	12,100	ft²
Footprint Aspect Ratio (L:W)	2			
Percent Conditioned Space	100%			
Percent Conditioned Space Defined as Exterior Zone	45%			
Typical # Stories	19			
Floor to Floor Height (m)	3.7	m	12.0	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	100%		0%		0%		0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	40	m²/person	430	ft²/person
Occupancy Schedule Occ. Period	25%			
Occupancy Schedule Unocc. Period	80%			
Fresh Air Requirements or Outside Air	10	L/s.person	21	CFM/person

%OA 100.00%

Fresh Air Control Type *(enter a 1, 2 or 3) 3
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right: 0%
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation 0.25 L/s.m² 0.05 CFM/ft²
75% operation (%)

Sizing Factor	1			
Total Air Circulation or Design Air Flow	0.25	L/s.m²	0.05	CFM/ft²
Infiltration Rate	0.05	L/s.m²	0.01	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)		L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	3,206,558	
Peak Zone Sensible Load	2,124,881	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	98,849	
Total air circulation or Design air	2.18	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	20	°C	68	°F	13	°C	55.4	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	20.4	°C	68.72	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Large High Rise	**> 9,300 m² (100,000 ft²)**		**Inland North**
Baseline			

LIGHTING

GENERAL (Linear Fluorescent) LIGHTING

Light Level	160	Lux	14.9	ft-candles
Floor Fraction (GLFF)	0.10			
Connected Load	4.6	W/m²	0.4	W/ft²

Occ. Period(Hrs./yr.)	3400
Unocc. Period(Hrs./yr.)	5360
Usage During Occupied Period	90%
Usage During Unoccupied Period	90%

Light Level (Lux)	50	100	200	300				Total
% Distribution	0%	60%	20%	20%				100%
Weighted Average								**160**
	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			60.0%	0%	40.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

Fixture Cleaning:
Incidence of Practice
Interval — years

Relamping Strategy & Incidence of Practice	Group	Spot

EUI	kWh/ft².yr	0.3
	MJ/m².yr	13

ARCHITECTURAL (Incandescent & replacements) LIGHTING

Light Level	130	Lux	12.1	ft-candles
Floor Fraction (ALFF)	0.90			
Connected Load	13.7	W/m²	1.3	W/ft²

Occ. Period(Hrs./yr.)	2900
Unocc. Period(Hrs./yr.)	5860
Usage During Occupied Period	25%
Usage During Unoccupied Period	20%

Light Level (Lux)	50	200	300	500				Total
% Distribution	60%	20%	20%	0%				100%
Weighted Average								**130**
	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	60%	40%					0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

Fixture Cleaning:
Incidence of Practice
Interval — years

Relamping Strategy & Incidence of Practice	Group	Spot

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	2.2
	MJ/m².yr	84

SPECIAL PURPOSE LIGHTING

Light Level	0.00	Lux	0.0	ft-candles
Floor Fraction (HBLFF)	0.00			
Connected Load	0.0	W/m²	0.0	W/ft²

Floor fraction check: should = 1.00	1.00

Occ. Period(Hrs./yr.)	4000
Unocc. Period(Hrs./yr.)	4760
Usage During Occupied Period	0%
Usage During Unoccupied Period	100%

Light Level (Lux)	300	500	700	1000				Total
% Distribution		0%	0%	0%				0%
Weighted Average								**0**
	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)								0.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

Fixture Cleaning:
Incidence of Practice
Interval — years

Relamping Strategy & Incidence of Practice	Group	Spot

EUI	kWh/ft².yr	0.0
	MJ/m².yr	0

TOTAL LIGHTING

Overall LPD	12.80 W/m²	EUI TOTAL	kWh/ft².yr	2.5
	1.19 W/ft²		MJ/m².yr	97

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Servers	Plug Loads
Measured Power (W/device)	45	57	100	200	50	
Density (device/occupant)	0.6	0.6	0	0	0.00	
Connected Load	0.7 W/m²	0.9 W/m²	0.0 W/m²	0.0 W/m²	0.5 W/m²	1.3 W/m²
	0.1 W/ft²	0.1 W/ft²	0.00 W/ft²	0.00 W/ft²	0.05 W/ft²	0.12 W/ft²
Diversity Occupied Period	0%	0%	90%	90%	100%	40%
Diversity Unoccupied Period	50%	50%	50%	10%	100%	85%
Operation Occ. Period (hrs./year)	2900	2900	2600	2600	2600	3000
Operation Unocc. Period (hrs./year)	5860	5860	6160	6160	6160	5760

Total end-use load (occupied period)	1.0 W/m²	0.1 W/ft²
Total end-use load (unocc. period)	2.4 W/m²	0.2 W/ft²

Usage during occupied period	100%
Usage during unoccupied period	231%

Computer Equipment	EUI	kWh/ft².yr	0.84
		MJ/m².yr	32.38
Plug Loads	EUI	kWh/ft².yr	0.74
		MJ/m².yr	28.53

FOOD SERVICE EQUIPMENT

Provide description below:
Electric stoves (at 417 kWh/yr), etc.

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	0.3	EUI	kWh/ft².yr	0.7
	MJ/m².yr	10.0		MJ/m².yr	27.0

REFRIGERATION

Provide description below:
Residential refrigerators (560 kWh/yr) and freezers (370 kWh/yr)

EUI	kWh/ft².yr	0.8
	MJ/m².yr	30.0

MISCELLANEOUS

Provide description below:
Dryers, pools, fireplaces

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	1.0	EUI	kWh/ft².yr	0.0
	MJ/m².yr	40.0		MJ/m².yr	0.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large High Rise	> 9,300 m^2 (100,000 ft^2)		Inland North
Baseline			

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	35%	20%	5%	20%	5%	0%	3%	3%	9%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff.) (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	40.2 W/m^2	12.8 Btu/hr.ft^2	
Seasonal Heating Load (Tertiary Load)	394 MJ/m^2.yr	10.2 kWh/ft^2.yr	
Sizing Factor	1.00		
Electric Fuel Share	15.0%	Fossil Fuel Share	85.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft^2.yr	8.0
MJ/m^2.yr	309

Gas EUI	
kWh/ft^2.yr	13.2
MJ/m^2.yr	511

Market Composite EUI	
kWh/ft^2.yr	12.4
MJ/m^2.yr	481

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	1.0%	0.0%		5.0%	94.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7 °C	44.6 °F
Condenser Water	30 °C	86 °F
Supply Air	13.0 °C	55.4 °F

Peak Cooling Load	7 W/m^2	2 Btu/hr.ft^2	5735 ft^2/Ton
Seasonal Cooling Load (Tertiary Load)	66.4 MJ/m^2.yr	1.7 kWh/ft^2.yr	
Sizing Factor	0.15	Operation (occ. period)	3000 hrs/year Note value cannot be less than 2,900 hrs/year)
A/C Saturation (Incidence of A/C)	11.0%		
Electric Fuel Share	100.0%	Gas Fuel Share	0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft^2.yr	0.4
MJ/m^2.yr	17

Natural Gas EUI	
kWh/ft^2.yr	0.0
MJ/m^2.yr	0

Market Composite EUI	
kWh/ft^2.yr	0.4
MJ/m^2.yr	17

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	25%				50%
Eff./COP	0.65				0.75

	Fossil		Elec. Res.
Fuel Share	75%		25%
Blended Efficiency	0.72		1.00

Service Hot Water load (MJ/m^2.yr) (Tertiary Load): 200.0

Wetting Use Percentage: 80%

All Electric EUI	
kWh/ft^2.yr	5.2
MJ/m^2.yr	200

Fossil Fuel EUI	
kWh/ft^2.yr	7.2
MJ/m^2.yr	279

Market Composite EUI	
kWh/ft^2.yr	6.7
MJ/m^2.yr	259.3

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large High Rise	> 9,300 m² (100,000 ft²)		Inland North
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	0.3	L/s.m²	0.05	CFM/ft²
System Static Pressure CAV	625	Pa	2.5	wg
System Static Pressure VAV	0	Pa	0.0	wg
Fan Efficiency	52%			
Fan Motor Efficiency	90%			
Sizing Factor	1.00			
Fan Design Load CAV	0.3	W/m²	0.03	W/ft²
Fan Design Load VAV	0.0	W/m²	0.00	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	100%	0%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	75%	25%	75%	25%
Comments:				

EXHAUST FANS

Washroom Exhaust	50	L/s.washroom	106	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m²	0.02	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.2	L/s.m²	0.04	CFM/ft²
Exhaust System Static Pressure	125	Pa	0.5	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.1	W/m²	0.01	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.000	kW/kW	0.00	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	0.00	W/m²	0.00	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.000	L/s.m²	0.001	U.S. gpm/ft²
Pump Head Pressure	0	kPa	0	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.00	W/m²	0.00	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.000	L/s.m²	0.0004	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.1	W/m²	0.01	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	2.5	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	0.9	kWh/m².yr
Condenser Pump Energy Consumption	0.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.0	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	0.3	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI		
	kWh/ft².yr	0.3
	MJ/m².yr	13.3

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: Large High Rise Baseline
SIZE: > 9,300 m² (100,000 ft²)
VINTAGE:
REGION: Inland North

EUI SUMMARY

TOTAL ALL END-USES: **Electricity:** **9.3** kWh/ft².yr **359.4** MJ/m².yr **Fossil Fue** **17.9** kWh/ft².yr **693.6** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL (Linear Fluorescent) LIGHT	0.3	13.1
ARCHITECTURAL (Incandescent & re	2.2	84.3
SPECIAL PURPOSE LIGHTING	0.0	0.0
OTHER PLUG LOADS	0.7	28.5
HVAC FANS & PUMPS	0.3	13.3
REFRIGERATION	0.8	30.0
COMPUTER EQUIPMENT	0.8	32.4
ELEVATORS	0.4	15.5
OUTDOOR LIGHTING	0.4	17.0

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	1.2	46.4	11.2	434.3
SPACE COOLING	0.0	1.9	0.0	0.0
DOMESTIC HOT WATER	1.3	50.0	5.4	209.3
FOOD SERVICE EQUIPMENT	0.7	27.0	0.3	10.0
MISCELLANEOUS	0.0	0.0	1.0	40.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **Medium Apartment** **Baseline** | **SIZE:** | **VINTAGE:** | **REGION:** **Inland North**

CONSTRUCTION

Wall U value (W/m².°C)	0.69 W/m².°C	0.12 Btu/hr.ft².°F		
Roof U value (W/m².°C)	0.46 W/m².°C	0.08 Btu/hr.ft².°F		
Glazing U value (W/m².°C)	3.74 W/m².°C	0.66 Btu/hr.ft².°F		
Window/Wall Ratio (WIWAR) (%)	0.25			
Shading Coefficient (SC)	0.65			

Typical Building Size	8,000 m²	86,080 ft²
Typical Footprint (m²)	1,600 m²	17,216 ft²
Footprint Aspect Ratio (L:W)	3	
Percent Conditioned Space	100%	
Percent Conditioned Space Defined as Exterior Zone	45%	
Typical # Stories	5	
Floor to Floor Height (m)	3.7 m	12.0 ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	100%		0%		0%		0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	40 m²/person	430 ft²/person
Occupancy Schedule Occ. Period	25%	
Occupancy Schedule Unocc. Period	80%	
Fresh Air Requirements or Outside Air	10 L/s.person	21 CFM/person

%OA 100.00%

Fresh Air Control Type *(enter a 1, 2 or 3) (1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air): 3

If Fresh Air Control Type = "2" enter % FA. to the right: 0%

If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation: 0.25 L/s.m² | 0.05 CFM/ft² | 75% operation (%)

Sizing Factor	1	
Total Air Circulation or Design Air Flow	0.25 L/s.m²	0.05 CFM/ft²
Infiltration Rate (air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)	0.05 L/s.m²	0.01 CFM/ft²

Separate Make-up air unit (100% OA)	L/s.m²	0.00 CFM/ft²
Operation occupied period	50%	
Operation unoccupied period	50%	

Economizer

	Enthalpy Based		Dry-Bulb Based	Total
Incidence of Use	0%		100%	100%
Switchover Point		KJ/kg.	18 °C	
		Btu/lbm	64.4 °F	

Summary of Design Parameters		
Peak Design Cooling Load	1,171,201	
Peak Zone Sensible Load	766,183	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	35,643	
Total air circulation or Design air	2.10	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	20	°C	68	°F	13	°C	55.4	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	20.4	°C	68.72	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Apartment			Inland North
Baseline			

LIGHTING

GENERAL (Linear Fluorescent) LIGHTING

Light Level	160	Lux	14.9	ft-candles
Floor Fraction (GLFF)	0.10			
Connected Load	4.6	W/m²	0.4	W/ft²

Occ. Period(Hrs./yr.)	3400
Unocc. Period(Hrs./yr.)	5360
Usage During Occupied Period	90%
Usage During Unoccupied Period	90%
Fixture Cleaning:	
Incidence of Practice	
Interval	years
Relamping Strategy & Incidence of Practice	Group / Spot

Light Level (Lux)	50	100	200	300				Total
% Distribution	0%	60%	20%	20%				100%
Weighted Average								**160**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			60.0%	0%	40.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	0.3
	MJ/m².yr	13

ARCHITECTURAL (Incandescent & replacements) LIGHTING

Light Level	130	Lux	12.1	ft-candles
Floor Fraction (ALFF)	0.90			
Connected Load	13.7	W/m²	1.3	W/ft²

Occ. Period(Hrs./yr.)	2900
Unocc. Period(Hrs./yr.)	5860
Usage During Occupied Period	25%
Usage During Unoccupied Period	20%
Fixture Cleaning:	
Incidence of Practice	
Interval	years
Relamping Strategy & Incidence of Practice	Group / Spot

Light Level (Lux)	50	200	300	500				Total
% Distribution	60%	20%	20%	0%				100%
Weighted Average								**130**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	60%	40%					0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	2.2
	MJ/m².yr	84

SPECIAL PURPOSE LIGHTING

Light Level	0.00	Lux	0.0	ft-candles
Floor Fraction (HBLFF)	0.00			
Connected Load	0.0	W/m²	0.0	W/ft²

Floor fraction check: should = 1.00 | 1.00

Occ. Period(Hrs./yr.)	4000
Unocc. Period(Hrs./yr.)	4760
Usage During Occupied Period	0%
Usage During Unoccupied Period	100%
Fixture Cleaning:	
Incidence of Practice	
Interval	years
Relamping Strategy & Incidence of Practice	Group / Spot

Light Level (Lux)	300	500	700	1000				Total
% Distribution		0%	0%	0%				0%
Weighted Average								**0**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)								0.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	0.0
	MJ/m².yr	0

TOTAL LIGHTING

Overall LPD	12.80 W/m²	EUI TOTAL	kWh/ft².yr	2.5
	1.19 W/ft²		MJ/m².yr	97

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Servers	Plug Loads
Measured Power (W/device)	45	57	100	200	50	
Density (device/occupant)	0.6	0.6	0	0	0.00	
Connected Load	0.7 W/m²	0.9 W/m²	0.0 W/m²	0.0 W/m²	0.5 W/m²	1.3 W/m²
	0.1 W/ft²	0.1 W/ft²	0.00 W/ft²	0.00 W/ft²	0.05 W/ft²	0.12 W/ft²
Diversity Occupied Period	0%	0%	90%	90%	100%	40%
Diversity Unoccupied Period	50%	50%	50%	10%	100%	85%
Operation Occ. Period (hrs./year)	2900	2900	2600	2600	2600	3000
Operation Unocc. Period (hrs./year)	5860	5860	6160	6160	6160	5760

Total end-use load (occupied period)	1.0 W/m²	0.1 W/ft²
Total end-use load (unocc. period)	2.4 W/m²	0.2 W/ft²
Usage during occupied period	100%	
Usage during unoccupied period	231%	

	EUI		
Computer Equipment	EUI	kWh/ft².yr	0.84
		MJ/m².yr	32.38
Plug Loads	EUI	kWh/ft².yr	0.74
		MJ/m².yr	28.53

FOOD SERVICE EQUIPMENT

Provide description below:

Electric stoves (at 417 kWh/yr), etc.

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	0.1	EUI	kWh/ft².yr	0.7
	MJ/m².yr	5.0		MJ/m².yr	27.0

REFRIGERATION

Provide description below:

Residential refrigerators (560 kWh/yr) and freezers (370 kWh/yr)

EUI	kWh/ft².yr	0.8
	MJ/m².yr	30.0

MISCELLANEOUS

Provide description below:

pools, dryers, fireplaces, bbq etc

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	0.8	EUI	kWh/ft².yr	0.0
	MJ/m².yr	30.0		MJ/m².yr	0.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Apartment			Inland North
Baseline			

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	30%	10%	5%	20%	15%	0%	3%	3%	14%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff.) (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	40.2	W/m²	12.8	Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	397	MJ/m².yr	10.3	kWh/ft².yr
Sizing Factor	1.00			
Electric Fuel Share	20.0%	Fossil Fuel Share	80.0%	

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	8.6
MJ/m².yr	333

Gas EUI	
kWh/ft².yr	13.3
MJ/m².yr	514

Market Composite EUI	
kWh/ft².yr	12.3
MJ/m².yr	478

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	0.0%	0.0%		0.0%	100.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7	°C	44.6	°F
Condenser Water	30	°C	86	°F
Supply Air	13.0	°C	55.4	°F

Peak Cooling Load	6	W/m²	2	Btu/hr.ft²	5880	ft²/Ton
Seasonal Cooling Load (Tertiary Load)	63.2	MJ/m².yr	1.6	kWh/ft².yr		

Sizing Factor: 0.15 — Operation (occ. period): 3000 hrs/year — Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C): 11.0%

Electric Fuel Share: 100.0% — Gas Fuel Share: 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	0.4
MJ/m².yr	17

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	0.4
MJ/m².yr	17

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	50%				20%
Eff./COP	0.65				0.75

	Fossil		Elec. Res.
Fuel Share	70%		30%
Blended Efficiency	0.68		1.00

Service Hot Water load (MJ/m².yr) (Tertiary Load): 180.0

Wetting Use Percentage: 80%

All Electric EUI	
kWh/ft².yr	4.6
MJ/m².yr	180

Fossil Fuel EUI	
kWh/ft².yr	6.8
MJ/m².yr	265

Market Composite EUI	
kWh/ft².yr	6.2
MJ/m².yr	239.7

EXISTING BUILDINGS: Medium Apartment Baseline | **SIZE:** | **VINTAGE:** | **REGION:** Inland North

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	0.3	L/s.m²	0.05	CFM/ft²
System Static Pressure CAV	625	Pa	2.5	wg
System Static Pressure VAV	0	Pa	0.0	wg
Fan Efficiency	52%			
Fan Motor Efficiency	90%			
Sizing Factor	1.00			
Fan Design Load CAV	0.3	W/m²	0.03	W/ft²
Fan Design Load VAV	0.0	W/m²	0.00	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	100%	0%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	75%	25%	75%	25%

Comments:

EXHAUST FANS

Washroom Exhaust	50	L/s.washroom	106	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m²	0.01	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.2	L/s.m²	0.03	CFM/ft²
Exhaust System Static Pressure	125	Pa	0.5	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.1	W/m²	0.01	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.000	kW/kW	0.00	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	0.00	W/m²	0.00	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.000	L/s.m²	0.001	U.S. gpm/ft²
Pump Head Pressure	0	kPa	0	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.00	W/m²	0.00	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.000	L/s.m²	0.0004	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.1	W/m²	0.01	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	2.5	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	0.8	kWh/m².yr
Condenser Pump Energy Consumption	0.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.0	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	0.3	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI	kWh/ft².yr	0.3
	MJ/m².yr	12.8

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Apartment			Inland North
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	Electricity:	9.8 kWh/ft².yr	379.2 MJ/m².yr	Fossil Fue	16.3 kWh/ft².yr	631.7 MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL (Linear Fluorescent) LIGHT	0.3	13.1
ARCHITECTURAL (Incandescent & re	2.2	84.3
SPECIAL PURPOSE LIGHTING	0.0	0.0
OTHER PLUG LOADS	0.7	28.5
HVAC FANS & PUMPS	0.3	12.8
REFRIGERATION	0.8	30.0
COMPUTER EQUIPMENT	0.8	32.4
ELEVATORS	0.3	11.6
OUTDOOR LIGHTING	0.4	17.0

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	1.7	66.6	10.6	411.0
SPACE COOLING	0.0	1.8	0.0	0.0
DOMESTIC HOT WATER	1.4	54.0	4.8	185.7
FOOD SERVICE EQUIPMENT	0.7	27.0	0.1	5.0
MISCELLANEOUS	0.0	0.0	0.8	30.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Office	> 9,300 m² (100,000 ft²)		Inland South
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.91	W/m².°C	0.16	Btu/hr.ft² . °F
Roof U value (W/m².°C)	0.61	W/m².°C	0.11	Btu/hr.ft² . °F
Glazing U value (W/m².°C)	4.29	W/m².°C	0.75	Btu/hr.ft² . °F
Window/Wall Ratio (WIWAR) (%)	0.41			
Shading Coefficient (SC)	0.58			

Typical Building Size	21,365	m²	229,887	ft²
Typical Footprint (m²)	1,526	m²	16,421	ft²
Footprint Aspect Ratio (L:W)	1			
Percent Conditioned Space	100%			
Percent Conditioned Space Defined as Exterior Zone	45%			
Typical # Stories	14			
Floor to Floor Height (m)	3.7	m	12.0	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	50%		0%		50%		0%		100%
Min. Air Flow (%)					40%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	26	m²/person	274	ft²/person
Occupancy Schedule Occ. Period	90%			
Occupancy Schedule Unocc. Period	0%			
Fresh Air Requirements or Outside Air	20	L/s.person	42	CFM/person

%OA 12.46%

Fresh Air Control Type *(enter a 1, 2 or 3) 1
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)
If Fresh Air Control Type = "2" enter % FA. to the right:
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation L/s.m² 0.00 CFM/ft²
operation (%)

Sizing Factor	1.6			
Total Air Circulation or Design Air Flow	6.29	L/s.m²	1.24	CFM/ft²
Infiltration Rate	0.70	L/s.m²	0.14	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)		L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	7,306,640	
Peak Zone Sensible Load	3,827,880	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	178,073	
Total air circulation or Design air	6.29	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	24	°C	75.2	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				98%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	19.5	°C	67.1	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Office	> 9,300 m^2 (100,000 ft^2)		Inland South
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	600	Lux	55.8	ft-candles
Floor Fraction (GLFF)	0.90			
Connected Load	16.6	W/m^2	1.5	W/ft^2
Occ. Period(Hrs./yr.)	2900			
Unocc. Period(Hrs./yr.)	5860			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	35%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	500	600	700	800			Total
% Distribution	25%	50%	25%	0%			100%
Weighted Average							**600**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			37.5%	0%	62.5%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft^2.yr	6.7
	MJ/m^2.yr	259

ARCHITECTURAL LIGHTING

Light Level	350	Lux	32.5	ft-candles
Floor Fraction (ALFF)	0.10			
Connected Load	29.7	W/m^2	2.8	W/ft^2
Occ. Period(Hrs./yr.)	3400			
Unocc. Period(Hrs./yr.)	5360			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	50%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	200	300	400	500			Total
% Distribution	10%	40%	40%	10%			100%
Weighted Average							**350**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	40%	60%					0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft^2.yr	1.6
	MJ/m^2.yr	63

SPECIAL PURPOSE LIGHTING

Light Level	0.00	Lux	0.0	ft-candles
Floor Fraction (HBLFF)	0.00			
Connected Load	0.0	W/m^2	0.0	W/ft^2
Occ. Period(Hrs./yr.)	4000			
Unocc. Period(Hrs./yr.)	4760			
Usage During Occupied Period	0%			
Usage During Unoccupied Period	100%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 | 1.00

Light Level (Lux)	300	500	700	1000			Total
% Distribution		0%	0%	0%			0%
Weighted Average							**0**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)								0.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft^2.yr	0.0
	MJ/m^2.yr	0

TOTAL LIGHTING

Overall LPD	17.94 W/m^2	EUI TOTAL	kWh/ft^2.yr	8.3
	1.67 W/ft^2		MJ/m^2.yr	322

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Servers		Plug Loads	
Measured Power (W/device)	55		51		100		200		217			
Density (device/occupant)	0.9		0.9		0.15		0.1		0.06			
Connected Load	1.9	W/m^2	1.8	W/m^2	0.6	W/m^2	0.8	W/m^2	0.5	W/m^2	2.5	W/m^2
	0.2	W/ft^2	0.2	W/ft^2	0.05	W/ft^2	0.07	W/ft^2	0.05	W/ft^2	0.23	W/ft^2
Diversity Occupied Period	90%		90%		90%		90%		100%		90%	
Diversity Unoccupied Period	50%		50%		50%		50%		100%		25%	
Operation Occ. Period (hrs./year)	2500		2500		2500		2500		2500		3000	
Operation Unocc. Period (hrs./year)	6260		6260		6260		6260		6260		5760	

Total end-use load (occupied period)	7.3	W/m^2	0.7	W/ft^2
Total end-use load (unocc. period)	3.7	W/m^2	0.3	W/ft^2
Usage during occupied period	100%			
Usage during unoccupied period	50%			

Computer Equipment	EUI	kWh/ft^2.yr	2.96
		MJ/m^2.yr	114.76
Plug Loads	EUI	kWh/ft^2.yr	0.96
		MJ/m^2.yr	37.26

FOOD SERVICE EQUIPMENT

Provide description below:

Cafeteria

Gas EUI			Electric EUI		
EUI	kWh/ft^2.yr	0.3	EUI	kWh/ft^2.yr	0.1
	MJ/m^2.yr	10.0		MJ/m^2.yr	3.0

REFRIGERATION

Provide description below:

Cafeteria

EUI	kWh/ft^2.yr	0.1
	MJ/m^2.yr	4.0

MISCELLANEOUS

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft^2.yr	0.5	EUI	kWh/ft^2.yr	0.0
	MJ/m^2.yr	20.0		MJ/m^2.yr	0.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Office	> 9,300 m^2 (100,000 ft^2)		Inland South
Baseline			

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	65%	15%	5%	10%	0%	0%	1%	1%	3%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff.) (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load: 37.7 W/m^2 — 12.0 Btu/hr.ft^2

Seasonal Heating Load (Tertiary Load): 286 MJ/m^2.yr — 7.4 kWh/ft^2.yr

Sizing Factor: 1.00

Electric Fuel Share: 5.0% — Fossil Fuel Share: 95.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft^2.yr	5.8
MJ/m^2.yr	224

Gas EUI	
kWh/ft^2.yr	9.6
MJ/m^2.yr	374

Market Composite EUI	
kWh/ft^2.yr	9.5
MJ/m^2.yr	366

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	56.0%	24.0%		5.0%	15.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

	°C	°F
Chilled Water	7 °C	44.6 °F
Condenser Water	30 °C	86 °F
Supply Air	14.0 °C	57.2 °F

Peak Cooling Load: 100 W/m^2 — 32 Btu/hr.ft^2 — 378 ft^2/Ton

Seasonal Cooling Load (Tertiary Load): 225.2 MJ/m^2.yr — 5.8 kWh/ft^2.yr

Sizing Factor: 1.00 — Operation (occ. period): 3000 hrs/year Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C): 90.0%

Electric Fuel Share: 100.0% — Gas Fuel Share: 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft^2.yr	1.9
MJ/m^2.yr	75

Natural Gas EUI	
kWh/ft^2.yr	0.0
MJ/m^2.yr	0

Market Composite EUI	
kWh/ft^2.yr	1.9
MJ/m^2.yr	75

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	40%				20%
Eff./COP	0.65				0.75

	Fossil	Elec. Res.
Fuel Share	60%	40%
Blended Efficiency	0.68	0.91

Service Hot Water load (MJ/m^2.yr) (Tertiary Load): 40.0

Wetting Use Percentage: 90%

All Electric EUI	
kWh/ft^2.yr	1.1
MJ/m^2.yr	44

Fossil Fuel EUI	
kWh/ft^2.yr	1.5
MJ/m^2.yr	59

Market Composite EUI	
kWh/ft^2.yr	1.4
MJ/m^2.yr	52.7

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Office	> 9,300 m² (100,000 ft²)		Inland South
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	6.3	L/s.m²	1.24	CFM/ft²
System Static Pressure CAV	875	Pa	3.5	wg
System Static Pressure VAV	875	Pa	3.5	wg
Fan Efficiency	52%			
Fan Motor Efficiency	90%			
Sizing Factor	1.00			
Fan Design Load CAV	11.8	W/m²	1.09	W/ft²
Fan Design Load VAV	11.8	W/m²	1.09	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	50%	50%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	50%	50%	50%	50%
Comments:				

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m²	0.03	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.2	L/s.m²	0.05	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	40%			
Fan Motor Efficiency	80%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.2	W/m²	0.02	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.020	kW/kW	0.07	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	2.00	W/m²	0.19	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.005	L/s.m²	0.008	U.S. gpm/ft²
Pump Head Pressure	90	kPa	30	ft
Pump Efficiency	55%			
Pump Motor Efficiency	90%			
Sizing Factor	1.0			
Pump Connected Load	0.97	W/m²	0.09	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.004	L/s.m²	0.0064	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	150	kPa	50	ft		
Pump Efficiency	55%					
Pump Motor Efficiency	90%					
Sizing Factor	0.8					
Pump Connected Load	1.0	W/m²	0.10	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	55.9	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	1.1	kWh/m².yr
Condenser Pump Energy Consumption	3.1	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	1.1	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	5.2	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI		
	kWh/ft².yr	6.2
	MJ/m².yr	239.0

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: Large Office Baseline

SIZE: > 9,300 m² (100,000 ft²)

VINTAGE:

REGION: Inland South

EUI SUMMARY

TOTAL ALL END-USES:	Electricity:	21.9	kWh/ft².yr	849.1	MJ/m².yr	Fossil Fuel	10.8	kWh/ft².yr	420.2	MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	6.7	259.0
ARCHITECTURAL LIGHTING	1.6	63.3
SPECIAL PURPOSE LIGHTING	0.0	0.0
OTHER PLUG LOADS	1.0	37.3
HVAC FANS & PUMPS	6.2	239.0
REFRIGERATION	0.1	4.0
COMPUTER EQUIPMENT	3.0	114.8
ELEVATORS	0.4	15.5
OUTDOOR LIGHTING	0.4	17.0

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.3	11.2	9.2	355.0
SPACE COOLING	1.7	67.6	0.0	0.0
DOMESTIC HOT WATER	0.5	17.6	0.9	35.1
FOOD SERVICE EQUIPMENT	0.1	3.0	0.3	10.0
MISCELLANEOUS	0.0	0.0	0.5	20.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: Medium Office Baseline
SIZE: 50,000 to 100,000 ft²
VINTAGE:
REGION: Inland South

CONSTRUCTION

Wall U value (W/m².°C)	0.88 W/m².°C	0.15 Btu/hr.ft² . °F		
Roof U value (W/m².°C)	0.61 W/m².°C	0.11 Btu/hr.ft² . °F		
Glazing U value (W/m².°C)	4.29 W/m².°C	0.75 Btu/hr.ft² . °F		
Window/Wall Ratio (WIWAR) (%)	0.36			
Shading Coefficient (SC)	0.58			

Typical Building Size	6,777 m²	72,921 ft²
Typical Footprint (m²)	753 m²	8,102 ft²
Footprint Aspect Ratio (L:W)	1	
Percent Conditioned Space	100%	
Percent Conditioned Space Defined as Exterior Zone	45%	
Typical # Stories	9	
Floor to Floor Height (m)	3.7 m	12.0 ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	75%		0%		25%		0%		100%
Min. Air Flow (%)					60%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	26 m²/person	274 ft²/person
Occupancy Schedule Occ. Period	90%	
Occupancy Schedule Unocc. Period	0%	
Fresh Air Requirements or Outside Air	15 L/s.person	32 CFM/person

%OA 8.86%

Fresh Air Control Type *(enter a 1, 2 or 3) 1
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)
If Fresh Air Control Type = "2" enter % FA. to the right:
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation — L/s.m² — 0.00 CFM/ft² — operation (%)

Sizing Factor	1.5	
Total Air Circulation or Design Air Flow	6.64 L/s.m²	1.31 CFM/ft²
Infiltration Rate	0.70 L/s.m²	0.14 CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)		L/s.m²	0.00 CFM/ft²
Operation occupied period	50%		
Operation unoccupied period	50%		

Economizer

	Enthalpy Based	Dry-Bulb Based	Total
Incidence of Use	0%	100%	100%
Switchover Point	KJ/kg.	18 °C	
	Btu/lbm	64.4 °F	

Summary of Design Parameters		
Peak Design Cooling Load	2,209,561	
Peak Zone Sensible Load	1,366,713	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	63,579	
Total air circulation or Design air	6.64	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional	PI / PID	Total
Control Mode			0%
	Fixed Discharge	Reset	
Control Strategy			0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	24	°C	75.2	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				98%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	19.5	°C	67.1	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning — Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Office	50,000 to 100,000 ft²		Inland South
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	600	Lux	55.8	ft-candles
Floor Fraction (GLFF)	0.92			
Connected Load	16.6	W/m²	1.5	W/ft²
Occ. Period(Hrs./yr.)	2900			
Unocc. Period(Hrs./yr.)	5860			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	30%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	500	600	700	800	Total
% Distribution	25%	50%	25%	0%	100%
Weighted Average					**600**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			37.5%		62.5%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI		
	kWh/ft².yr	6.4
	MJ/m².yr	249

ARCHITECTURAL LIGHTING

Light Level	350	Lux	32.5	ft-candles
Floor Fraction (ALFF)	0.07			
Connected Load	31.5	W/m²	2.9	W/ft²
Occ. Period(Hrs./yr.)	3400			
Unocc. Period(Hrs./yr.)	5360			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	40%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	200	300	400	500	Total
% Distribution	10%	40%	40%	10%	100%
Weighted Average					**350**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	45%	55%					0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI		
	kWh/ft².yr	1.1
	MJ/m².yr	43

SPECIAL PURPOSE LIGHTING

Light Level	0.00	Lux	0.0	ft-candles
Floor Fraction (HBLFF)	0.01			
Connected Load	0.0	W/m²	0.0	W/ft²
Occ. Period(Hrs./yr.)	3400			
Unocc. Period(Hrs./yr.)	5360			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	40%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 | 1.00

Light Level (Lux)	300	500	700	1000	Total
% Distribution		0%	0%	0%	0%
Weighted Average					**0**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)						50%	50%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI		
	kWh/ft².yr	0.0
	MJ/m².yr	0

TOTAL LIGHTING	Overall LPD	17.51 W/m²	EUI TOTAL	kWh/ft².yr	7.5
		1.63 W/ft²		MJ/m².yr	291

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Servers	Plug Loads
Measured Power (W/device)	55	51	100	200	217	
Density (device/occupant)	0.9	0.9	0.15	0.1	0.06	
Connected Load	1.9 W/m²	1.8 W/m²	0.6 W/m²	0.8 W/m²	0.5 W/m²	1 W/m²
	0.2 W/ft²	0.2 W/ft²	0.05 W/ft²	0.07 W/ft²	0.05 W/ft²	0.09 W/ft²
Diversity Occupied Period	90%	90%	90%	90%	100%	80%
Diversity Unoccupied Period	50%	50%	50%	50%	100%	25%
Operation Occ. Period (hrs./year)	2500	2500	2500	2500	2500	2500
Operation Unocc. Period (hrs./year)	6260	6260	6260	6260	6260	6260

Total end-use load (occupied period)	5.9 W/m²	0.5 W/ft²
Total end-use load (unocc. period)	3.3 W/m²	0.3 W/ft²
Usage during occupied period	100%	
Usage during unoccupied period	56%	

	EUI		
Computer Equipment	EUI	kWh/ft².yr	2.96
		MJ/m².yr	114.76
Plug Loads	EUI	kWh/ft².yr	0.33
		MJ/m².yr	12.83

FOOD SERVICE EQUIPMENT

Provide description below:

Lunch room/cafeteria/restaurant

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	0.3	EUI	kWh/ft².yr	0.1
	MJ/m².yr	10.0		MJ/m².yr	4.0

REFRIGERATION

Provide description below:

Lunch room/cafeteria/restaurant

EUI		
	kWh/ft².yr	0.1
	MJ/m².yr	4.0

MISCELLANEOUS

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	0.5	EUI	kWh/ft².yr	0.0
	MJ/m².yr	20.0		MJ/m².yr	0.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **Medium Office** **Baseline**
SIZE: **50,000 to 100,000 ft²**
VINTAGE:
REGION: **Inland South**

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	30%	10%	5%	45%	0%	0%	3%	1%	6%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff. (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	41.4 W/m²	13.1 Btu/hr.ft²	
Seasonal Heating Load (Tertiary Load)	335 MJ/m².yr	8.7 kWh/ft².yr	
Sizing Factor	1.00		
Electric Fuel Share	10.0%	Fossil Fuel Share	90.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	7.0
MJ/m².yr	272

Gas EUI	
kWh/ft².yr	11.4
MJ/m².yr	440

Market Composite EUI	
kWh/ft².yr	10.9
MJ/m².yr	423

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	5.0%	5.0%	10.0%	30.0%	50.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7 °C	44.6 °F
Condenser Water	30 °C	86 °F
Supply Air	14.0 °C	57.2 °F

Peak Cooling Load	96 W/m²	30 Btu/hr.ft²	396 ft²/Ton
Seasonal Cooling Load (Tertiary Load)	211.3 MJ/m².yr	5.5 kWh/ft².yr	

Sizing Factor 1.00 — Operation (occ. period) 3000 hrs/year — Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C) 90.0%

Electric Fuel Share 100.0% — Gas Fuel Share 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	2.3
MJ/m².yr	88

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	2.3
MJ/m².yr	88

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	50%				10%
Eff./COP	0.65				0.75

	Fossil		Elec. Res.
Fuel Share	60%		40%
Blended Efficiency	0.67		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 35.0

Wetting Use Percentage 90%

All Electric EUI	
kWh/ft².yr	1.0
MJ/m².yr	38

Fossil Fuel EUI	
kWh/ft².yr	1.4
MJ/m².yr	53

Market Composite EUI	
kWh/ft².yr	1.2
MJ/m².yr	46.9

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Office	50,000 to 100,000 ft²		Inland South
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	6.6	L/s.m²	1.31	CFM/ft²
System Static Pressure CAV	750	Pa	3.0	wg
System Static Pressure VAV	750	Pa	3.0	wg
Fan Efficiency	52%			
Fan Motor Efficiency	85%			
Sizing Factor	1.00			
Fan Design Load CAV	11.3	W/m²	1.05	W/ft²
Fan Design Load VAV	11.3	W/m²	1.05	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	75%	25%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	75%	25%	75%	25%
Comments:				

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.3	L/s.m²	0.05	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.4	L/s.m²	0.07	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	40%			
Fan Motor Efficiency	80%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.3	W/m²	0.03	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.018	kW/kW	0.06	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	1.71	W/m²	0.16	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.005	L/s.m²	0.007	U.S. gpm/ft²
Pump Head Pressure	90	kPa	30	ft
Pump Efficiency	55%			
Pump Motor Efficiency	90%			
Sizing Factor	1.0			
Pump Connected Load	0.92	W/m²	0.09	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.004	L/s.m²	0.0061	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	150	kPa	50	ft		
Pump Efficiency	55%					
Pump Motor Efficiency	90%					
Sizing Factor	0.5					
Pump Connected Load	0.6	W/m²	0.06	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	77.5	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	2.1	kWh/m².yr
Condenser Pump Energy Consumption	1.3	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	1.0	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	3.1	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI		
	kWh/ft².yr	7.9
	MJ/m².yr	306.3

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Medium Office	**50,000 to 100,000 ft²**		**Inland South**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**22.8**	kWh/ft².yr	**883.7**	MJ/m².yr	**Fossil Fuel**	**11.8** kWh/ft².yr	**457.4** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	6.4	248.6
ARCHITECTURAL LIGHTING	1.1	42.7
SPECIAL PURPOSE LIGHTING	0.0	0.0
OTHER PLUG LOADS	0.3	12.8
HVAC FANS & PUMPS	7.9	306.3
REFRIGERATION	0.1	4.0
COMPUTER EQUIPMENT	3.0	114.8
ELEVATORS	0.3	11.6
OUTDOOR LIGHTING	0.4	17.0

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.7	27.2	10.2	395.9
SPACE COOLING	2.1	79.4	0.0	0.0
DOMESTIC HOT WATER	0.4	15.4	0.8	31.5
FOOD SERVICE EQUIPMENT	0.1	4.0	0.3	10.0
MISCELLANEOUS	0.0	0.0	0.5	20.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Large Retail	**> 100,000 ft²**		**Inland South**
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.73	W/m².°C	0.13	Btu/hr.ft² . °F	Typical Building Size	24,000 m²	258,240	ft²
Roof U value (W/m².°C)	0.61	W/m².°C	0.11	Btu/hr.ft² . °F	Typical Footprint (m²)	24,000 m²	258,240	ft²
Glazing U value (W/m².°C)	4.82	W/m².°C	0.85	Btu/hr.ft² . °F	Footprint Aspect Ratio (L:W)	15		
					Percent Conditioned Space	100%		
					Percent Conditioned Space Defined as Exterior Zone	40%		
Window/Wall Ratio (WIWAR) (%)	0.10							
Shading Coefficient (SC)	0.75				Typical # Stories	1		
					Floor to Floor Height (m)	4.6 m	15.0	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	95%		0%		5%		0%		100%
Min. Air Flow (%)					60%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	45	m²/person	484	ft²/person	%OA	13.48%
Occupancy Schedule Occ. Period	90%					
Occupancy Schedule Unocc. Period	0%					
Fresh Air Requirements or Outside Air	40	L/s.person	85	CFM/person		

Fresh Air Control Type *(enter a 1, 2 or 3): 1
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right: 0%
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation: 0.5 L/s.m² | 0.10 CFM/ft² | 50% operation (%)

Sizing Factor	1.8			
Total Air Circulation or Design Air Flow	6.59	L/s.m²	1.30	CFM/ft²
Infiltration Rate	0.70	L/s.m²	0.14	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	8,311,359	
Peak Zone Sensible Load	4,004,914	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	186,308	
Total air circulation or Design air	6.59	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	23	°C	73.4	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	21	°C	69.8	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning — Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Retail	**> 100,000 ft²**		**Inland South**
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	525	Lux	48.8	ft-candles
Floor Fraction (GLFF)	0.55			
Connected Load	15.1	W/m²	1.4	W/ft²
Occ. Period(Hrs./yr.)	4100			
Unocc. Period(Hrs./yr.)	4660			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	20%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	500	600	700	800	Total
% Distribution	75%	25%	0%	0%	100%
Weighted Average					**525**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			60.0%	0%	40.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI		
	kWh/ft².yr	3.7
	MJ/m².yr	145

ARCHITECTURAL LIGHTING

Light Level	505	Lux	46.9	ft-candles
Floor Fraction (ALFF)	0.30			
Connected Load	61.0	W/m²	5.7	W/ft²
Occ. Period(Hrs./yr.)	4100			
Unocc. Period(Hrs./yr.)	4660			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	30%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	400	500	600	700	Total
% Distribution	25%	50%	20%	5%	100%
Weighted Average					**505**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	75%	25%					0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI		
	kWh/ft².yr	9.0
	MJ/m².yr	349

SPECIAL PURPOSE LIGHTING

Light Level	500.00	Lux	46.5	ft-candles
Floor Fraction (HBLFF)	0.15			
Connected Load	23.3	W/m²	2.2	W/ft²
Occ. Period(Hrs./yr.)	4100			
Unocc. Period(Hrs./yr.)	4660			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	15%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 — 1.00

Light Level (Lux)	400	500	600	700	Total
% Distribution	40%	30%	20%	10%	100%
Weighted Average					**500**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)						100%		100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI		
	kWh/ft².yr	1.5
	MJ/m².yr	58

TOTAL LIGHTING

Overall LPD	26.64 W/m²	EUI TOTAL	kWh/ft².yr	14.2
	2.48 W/ft²		MJ/m².yr	552

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Servers		Plug Loads	
Measured Power (W/device)	55		51		100		200		217			
Density (device/occupant)	0.648828		0.648828		0.01		0.01		0.03			
Connected Load	0.8	W/m²	0.7	W/m²	0.0	W/m²	0.0	W/m²	0.5	W/m²	1.75	W/m²
	0.1	W/ft²	0.1	W/ft²	0.00	W/ft²	0.00	W/ft²	0.05	W/ft²	0.16	W/ft²
Diversity Occupied Period	90%		90%		90%		90%		100%		90%	
Diversity Unoccupied Period	50%		50%		50%		50%		100%		25%	
Operation Occ. Period (hrs./year)	2000		2000		2600		2600		2600		4100	
Operation Unocc. Period (hrs./year)	6760		6760		6160		6160		6160		4660	

Total end-use load (occupied period)	3.5	W/m²	0.3	W/ft²
Total end-use load (unocc. period)	1.7	W/m²	0.2	W/ft²
Usage during occupied period	100%			
Usage during unoccupied period	50%			

Computer Equipment	EUI	kWh/ft².yr	1.18
		MJ/m².yr	45.81
Plug Loads	EUI	kWh/ft².yr	0.79
		MJ/m².yr	30.59

FOOD SERVICE EQUIPMENT

Provide description below:

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	0.3	EUI	kWh/ft².yr	0.3
	MJ/m².yr	10.0		MJ/m².yr	10.0

REFRIGERATION

Provide description below:

Commercial refrigeration display cases

EUI		
	kWh/ft².yr	0.3
	MJ/m².yr	10.0

MISCELLANEOUS

Provide description below:

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	0.1	EUI	kWh/ft².yr	0.0
	MJ/m².yr	5.0		MJ/m².yr	0.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Retail	> 100,000 ft²		Inland South
Baseline			

SPACE HEATING

Heating Plant Type

							Electric			Other	
				Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	10%	8%	2%	60%	10%	0%	3%	2%	5%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff.) (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	37.3 W/m²	11.8 Btu/hr.ft²	
Seasonal Heating Load (Tertiary Load)	314 MJ/m².yr	8.1 kWh/ft².yr	
Sizing Factor	1.00		
Electric Fuel Share	10.0%	Fossil Fuel Share	90.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	6.0
MJ/m².yr	234

Gas EUI	
kWh/ft².yr	10.6
MJ/m².yr	412

Market Composite EUI	
kWh/ft².yr	10.2
MJ/m².yr	394

SPACE COOLING

A/C Plant Type

			WSHP			Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	10.0%	5.0%	0.0%	0.0%	85.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7 °C	44.6 °F
Condenser Water	30 °C	86 °F
Supply Air	14.0 °C	57.2 °F

Peak Cooling Load	101 W/m²	32 Btu/hr.ft²	373 ft²/Ton
Seasonal Cooling Load (Tertiary Load)	177.6 MJ/m².yr	4.6 kWh/ft².yr	

Sizing Factor 1.00 — Operation (occ. period) 3000 hrs/year — Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C) 80.0%

Electric Fuel Share 100.0% — Gas Fuel Share 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenan

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	1.7
MJ/m².yr	66

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	1.7
MJ/m².yr	66

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	35%				15%
Eff./COP	0.65				0.75

	Fossil		Elec. Res.
Fuel Share	50%		50%
Blended Efficiency	0.68		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 35.0

Wetting Use Percentage 90%

All Electric EUI	
kWh/ft².yr	1.0
MJ/m².yr	38

Fossil Fuel EUI	
kWh/ft².yr	1.3
MJ/m².yr	51

Market Composite EUI	
kWh/ft².yr	1.2
MJ/m².yr	45.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **Large Retail** **Baseline**

SIZE: **> 100,000 ft²**

VINTAGE:

REGION: **Inland South**

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	6.6	L/s.m²	1.30	CFM/ft²
System Static Pressure CAV	500	Pa	2.0	wg
System Static Pressure VAV	750	Pa	3.0	wg
Fan Efficiency	60%			
Fan Motor Efficiency	80%			
Sizing Factor	1.00			
Fan Design Load CAV	6.9	W/m²	0.64	W/ft²
Fan Design Load VAV	10.3	W/m²	0.96	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	95%	5%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	50%	50%	100%	0%
Comments:				

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.0	L/s.m²	0.00	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.1	L/s.m²	0.02	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.1	W/m²	0.01	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.024	kW/kW	0.08	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	2.38	W/m²	0.22	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.005	L/s.m²	0.008	U.S. gpm/ft²
Pump Head Pressure	0	kPa	0	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.00	W/m²	0.00	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.004	L/s.m²	0.0064	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	50	kPa	17	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.4	W/m²	0.04	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	42.2	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	1.3	kWh/m².yr
Condenser Pump Energy Consumption	0.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	1.0	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	2.2	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI	kWh/ft².yr	4.3
	MJ/m².yr	168.0

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Large Retail	**> 100,000 ft²**		**Inland South**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**24.7** kWh/ft².yr	**956.7** MJ/m².yr	**Fossil Fue**	**10.6** kWh/ft².yr	**411.7** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	3.7	144.8
ARCHITECTURAL LIGHTING	9.0	349.0
SPECIAL PURPOSE LIGHTING	1.5	57.8
OTHER PLUG LOADS	0.8	30.6
HVAC FANS & PUMPS	4.3	168.0
REFRIGERATION	0.3	10.0
COMPUTER EQUIPMENT	1.2	45.8
ELEVATORS	0.3	11.6
OUTDOOR LIGHTING	0.9	33.9

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.6	23.4	9.6	371.0
SPACE COOLING	1.4	52.6	0.0	0.0
DOMESTIC HOT WATER	0.5	19.2	0.7	25.7
FOOD SERVICE EQUIPMENT	0.3	10.0	0.3	10.0
MISCELLANEOUS	0.0	0.0	0.1	5.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: Medium Retail, Baseline
SIZE: 50,000 - 100,000 ft2
VINTAGE:
REGION: Inland South

CONSTRUCTION

Wall U value (W/m².°C)	0.73	W/m².°C	0.13	Btu/hr.ft² . °F
Roof U value (W/m².°C)	0.60	W/m².°C	0.11	Btu/hr.ft² . °F
Glazing U value (W/m².°C)	4.82	W/m².°C	0.85	Btu/hr.ft² . °F
Window/Wall Ratio (WIWAR) (%)	0.10			
Shading Coefficient (SC)	0.75			

Typical Building Size	7,500	m²	80,700	ft²
Typical Footprint (m²)	7,500	m²	80,700	ft²
Footprint Aspect Ratio (L:W)	5			
Percent Conditioned Space	100%			
Percent Conditioned Space Defined as Exterior Zone	29%			
Typical # Stories	1			
Floor to Floor Height (m)	5.0	m	16.5	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	100%		0%		0%		0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	25	m²/person	269	ft²/person
Occupancy Schedule Occ. Period	90%			
Occupancy Schedule Unocc. Period	0%			
Fresh Air Requirements or Outside Air	20	L/s.person	42	CFM/person

%OA 12.41%

Fresh Air Control Type *(enter a 1, 2 or 3) 1
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)
If Fresh Air Control Type = "2" enter % FA. to the right: 34%
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation 0.5 L/s.m² 0.10 CFM/ft²
50% operation (%)

Sizing Factor	1.5			
Total Air Circulation or Design Air Flow	6.45	L/s.m²	1.27	CFM/ft²
Infiltration Rate	0.42	L/s.m²	0.08	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based	Total
Incidence of Use	0%		100%	100%
Switchover Point		KJ/kg.	18	°C
		Btu/lbm	64.4	°F

Summary of Design Parameters		
Peak Design Cooling Load	2,714,016	
Peak Zone Sensible Load	1,468,403	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	68,310	
Total air circulation or Design air	6.45	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	21	°C	69.8	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	21	°C	69.8	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Retail	50,000 - 100,000 ft2		Inland South
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	550	Lux	51.1	ft-candles
Floor Fraction (GLFF)	0.70			
Connected Load	15.7	W/m²	1.5	W/ft²
Occ. Period(Hrs./yr.)	4800			
Unocc. Period(Hrs./yr.)	3960			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	20%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	450	500	700	1000				Total
% Distribution	20%	50%	30%	0%				100%
Weighted Average								**550**
	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			55.0%		45.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI kWh/ft².yr 5.5; MJ/m².yr 212

ARCHITECTURAL LIGHTING

Light Level	550	Lux	51.1	ft-candles
Floor Fraction (ALFF)	0.27			
Connected Load	60.8	W/m²	5.7	W/ft²
Occ. Period(Hrs./yr.)	4800			
Unocc. Period(Hrs./yr.)	3960			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	30%			
Fixture Cleaning:				
Incidence of Practice	95%			
Interval	20%	years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	450	500	700	1000				Total
% Distribution	20%	50%	30%	0%				100%
Weighted Average								**550**
	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	65%	35%					0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI kWh/ft².yr 8.8; MJ/m².yr 340

SPECIAL PURPOSE LIGHTING

Light Level	550.00	Lux	51.1	ft-candles
Floor Fraction (HBLFF)	0.03			
Connected Load	25.6	W/m²	2.4	W/ft²
Occ. Period(Hrs./yr.)	4800			
Unocc. Period(Hrs./yr.)	3960			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	20%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 | 1.00

Light Level (Lux)	450	500	700	1000				Total
% Distribution	20%	50%	30%	0%				100%
Weighted Average								**550**
	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)						100%		100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI kWh/ft².yr 0.4; MJ/m².yr 15

TOTAL LIGHTING

Overall LPD 27.44 W/m²; 2.55 W/ft²

EUI TOTAL kWh/ft².yr 14.6; MJ/m².yr 567

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Servers	Plug Loads
Measured Power (W/device)	55	51	100	200	217	
Density (device/occupant)	0.36046	0.36046	0.01	0.01	0.02	
Connected Load	0.8 W/m²	0.7 W/m²	0.0 W/m²	0.1 W/m²	0.5 W/m²	1.15 W/m²
	0.1 W/ft²	0.1 W/ft²	0.00 W/ft²	0.01 W/ft²	0.05 W/ft²	0.11 W/ft²
Diversity Occupied Period	90%	90%	90%	90%	100%	90%
Diversity Unoccupied Period	50%	50%	50%	50%	100%	25%
Operation Occ. Period (hrs./year)	2000	2000	2600	2600	2600	4100
Operation Unocc. Period (hrs./year)	6760	6760	6160	6160	6160	4660

Total end-use load (occupied period)	3.0 W/m²	0.3 W/ft²
Total end-use load (unocc. period)	1.6 W/m²	0.2 W/ft²
Usage during occupied period	100%	
Usage during unoccupied period	54%	

Computer Equipment EUI kWh/ft².yr 1.21; MJ/m².yr 46.85

Plug Loads EUI kWh/ft².yr 0.52; MJ/m².yr 20.10

FOOD SERVICE EQUIPMENT

Provide description below:

	Gas EUI	Electric EUI
EUI kWh/ft².yr	0.5	0.5
MJ/m².yr	20.0	20.0

REFRIGERATION

Provide description below:

EUI kWh/ft².yr 0.2; MJ/m².yr 8.6

MISCELLANEOUS

Provide description below:

	Gas EUI	Electric EUI
EUI kWh/ft².yr	0.3	0.0
MJ/m².yr	10.0	0.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **Medium Retail** **Baseline**
SIZE: **50,000 - 100,000 ft2**
VINTAGE:
REGION: **Inland South**

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	5%	2%	2%	55%	25%	0%	5%	1%	5%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff. (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	36.4	W/m²	11.5	Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	335	MJ/m².yr	8.6	kWh/ft².yr
Sizing Factor	1.00			
Electric Fuel Share	11.0%	Fossil Fuel Share	89.0%	

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	6.5
MJ/m².yr	252
Gas EUI	
kWh/ft².yr	11.3
MJ/m².yr	436
Market Composite EUI	
kWh/ft².yr	10.7
MJ/m².yr	416

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	10.0%	6.0%	0.0%	4.0%	80.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7	°C	44.6	°F
Condenser Water	30	°C	86	°F
Supply Air	14.0	°C	57.2	°F

Peak Cooling Load	106	W/m²	34	Btu/hr.ft²	357	ft²/Ton
Seasonal Cooling Load (Tertiary Load)	177.9	MJ/m².yr	4.6	kWh/ft².yr		

Sizing Factor: 1.00 — Operation (occ. period): 3000 hrs/year — Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C): 80.0%

Electric Fuel Share: 100.0% — Gas Fuel Share: 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	1.7
MJ/m².yr	67
Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0
Market Composite EUI	
kWh/ft².yr	1.7
MJ/m².yr	67

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	35%				10%
Eff./COP	0.65				0.75

	Fossil	Elec. Res.
Fuel Share	45%	55%
Blended Efficiency	0.67	0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load): 35.0

Wetting Use Percentage: 90%

	All Electric EUI	Fossil Fuel EUI	Market Composite EUI
kWh/ft².yr	1.0	1.3	1.2
MJ/m².yr	38	52	44.6

EXISTING BUILDINGS: Medium Retail Baseline
SIZE: 50,000 - 100,000 ft2
VINTAGE:
REGION: Inland South

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	6.4	L/s.m²	1.27	CFM/ft²
System Static Pressure CAV	500	Pa	2.0	wg
System Static Pressure VAV	500	Pa	2.0	wg
Fan Efficiency	60%			
Fan Motor Efficiency	88%			
Sizing Factor	1.00			
Fan Design Load CAV	6.1	W/m²	0.57	W/ft²
Fan Design Load VAV	6.1	W/m²	0.57	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	100%	0%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	50%	50%	50%	50%
Comments:				

EXHAUST FANS

Washroom Exhaust	50	L/s.washroom	106	CFM/washroom
Washroom Exhaust per gross unit are	0.0	L/s.m²	0.00	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.1	L/s.m²	0.02	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.2	W/m²	0.01	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.020	kW/kW	0.07	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	2.12	W/m²	0.20	W/ft²

Condenser Pump

Pump Design Flow	0.000	L/s.KW	0.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.000	L/s.m²	0.000	U.S. gpm/ft²
Pump Head Pressure	45	kPa	15	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.00	W/m²	0.00	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.005	L/s.m²	0.0067	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	0	kPa	0	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.0	W/m²	0.00	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	37.4	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	0.9	kWh/m².yr
Condenser Pump Energy Consumption	0.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.9	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	0.0	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI	kWh/ft².yr	3.6
	MJ/m².yr	141.2

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Medium Retail	**50,000 - 100,000 ft2**		**Inland South**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**24.4** kWh/ft².yr	**943.9** MJ/m².yr	**Fossil Fuel**	**11.4** kWh/ft².yr	**441.5** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	5.5	212.2
ARCHITECTURAL LIGHTING	8.8	339.9
SPECIAL PURPOSE LIGHTING	0.4	14.8
OTHER PLUG LOADS	0.5	20.1
HVAC FANS & PUMPS	3.6	141.2
REFRIGERATION	0.2	8.6
COMPUTER EQUIPMENT	1.2	46.9
ELEVATORS	0.1	3.9
OUTDOOR LIGHTING	0.9	33.9

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.7	27.7	10.0	388.0
SPACE COOLING	1.4	53.6	0.0	0.0
DOMESTIC HOT WATER	0.5	21.2	0.6	23.4
FOOD SERVICE EQUIPMENT	0.5	20.0	0.5	20.0
MISCELLANEOUS	0.0	0.0	0.3	10.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Food Retail			Inland South
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.73	W/m².°C	0.13	Btu/hr.ft² . °F	Typical Building Size	4,000 m²	43,040	ft²
Roof U value (W/m².°C)	0.60	W/m².°C	0.11	Btu/hr.ft² . °F	Typical Footprint (m²)	4,000 m²	43,040	ft²
Glazing U value (W/m².°C)	4.82	W/m².°C	0.85	Btu/hr.ft² . °F	Footprint Aspect Ratio (L:W)	1		
					Percent Conditioned Space	100%		
					Percent Conditioned Space Defined as Exterior Zone	40%		
Window/Wall Ratio (WIWAR) (%)	0.06							
Shading Coefficient (SC)	0.69				Typical # Stories	1		
					Floor to Floor Height (m)	4.6 m	15.0	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	100%		0%		0%		0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	45	m²/person	484	ft²/person
Occupancy Schedule Occ. Period	90%			
Occupancy Schedule Unocc. Period	0%			
Fresh Air Requirements or Outside Air	60	L/s.person	127	CFM/person

%OA 24.02%

Fresh Air Control Type *(enter a 1, 2 or 3) 1
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right: 0%
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation 0.5 L/s.m² 0.10 CFM/ft²
50% operation (%)

Sizing Factor	1.65			
Total Air Circulation or Design Air Flow	5.55	L/s.m²	1.09	CFM/ft²
Infiltration Rate	0.70	L/s.m²	0.14	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based	Total
Incidence of Use	0%		100%	100%
Switchover Point		KJ/kg.	18 °C	
		Btu/lbm	64.4 °F	

Summary of Design Parameters		
Peak Design Cooling Load	1,679,418	
Peak Zone Sensible Load	613,006	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	28,517	
Total air circulation or Design air	5.55	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	22	°C	71.6	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	21	°C	69.8	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning   Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Food Retail			Inland South
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	600 Lux	55.8	ft-candles
Floor Fraction (GLFF)	0.55		
Connected Load	16.7 W/m²	1.6	W/ft²
Occ. Period(Hrs./yr.)	4100		
Unocc. Period(Hrs./yr.)	4660		
Usage During Occupied Period	100%		
Usage During Unoccupied Period	40%		
Fixture Cleaning:			
Incidence of Practice			
Interval	years		
Relamping Strategy & Incidence of Practice	Group	Spot	

Light Level (Lux)	500	600	700	800				Total
% Distribution	25%	50%	25%	0%				100%
Weighted Average								**600**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			40.0%		60.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI kWh/ft².yr 5.1
MJ/m².yr 197

ARCHITECTURAL LIGHTING

Light Level	640 Lux	59.5	ft-candles
Floor Fraction (ALFF)	0.05		
Connected Load	80.6 W/m²	7.5	W/ft²
Occ. Period(Hrs./yr.)	4100		
Unocc. Period(Hrs./yr.)	4660		
Usage During Occupied Period	100%		
Usage During Unoccupied Period	50%		
Fixture Cleaning:			
Incidence of Practice			
Interval	years		
Relamping Strategy & Incidence of Practice	Group	Spot	

Light Level (Lux)	300	500	700	1000				Total
% Distribution	0%	30%	70%	0%				100%
Weighted Average								**640**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	80%	20%					0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI kWh/ft².yr 2.4
EUI = Load X Hrs. X SF X GLFF MJ/m².yr 93

SPECIAL PURPOSE LIGHTING

Light Level	620.00 Lux	57.6	ft-candles
Floor Fraction (HBLFF)	0.40		
Connected Load	28.9 W/m²	2.7	W/ft²
Occ. Period(Hrs./yr.)	4100		
Unocc. Period(Hrs./yr.)	4660		
Usage During Occupied Period	100%		
Usage During Unoccupied Period	50%		
Fixture Cleaning:			
Incidence of Practice			
Interval	years		
Relamping Strategy & Incidence of Practice	Group	Spot	

Floor fraction check: should = 1.00 | 1.00

Light Level (Lux)	300	500	700	1000				Total
% Distribution	0%	40%	60%	0%				100%
Weighted Average								**620**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)						100%		100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI kWh/ft².yr 6.9
MJ/m².yr 268

TOTAL LIGHTING Overall LPD 13.22 W/m² 1.23 W/ft²
EUI TOTAL kWh/ft².yr 14.4
MJ/m².yr 558

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Servers	Plug Loads
Measured Power (W/device)	55	51	100	200	217	
Density (device/occupant)	0.648828	0.648828	0.01	0.01	0.03	
Connected Load	0.8 W/m²	0.7 W/m²	0.0 W/m²	0.0 W/m²	0.5 W/m²	2.85 W/m²
	0.1 W/ft²	0.1 W/ft²	0.00 W/ft²	0.00 W/ft²	0.05 W/ft²	0.26 W/ft²
Diversity Occupied Period	90%	90%	90%	90%	100%	90%
Diversity Unoccupied Period	50%	50%	50%	50%	100%	50%
Operation Occ. Period (hrs./year)	2000	2000	2600	2600	2600	4100
Operation Unocc. Period (hrs./year)	6760	6760	6160	6160	6160	4660

Total end-use load (occupied period)	4.5 W/m²	0.4 W/ft²
Total end-use load (unocc. period)	2.7 W/m²	0.3 W/ft²
Usage during occupied period	100%	
Usage during unoccupied period	61%	

Computer Equipment EUI kWh/ft².yr 1.18
MJ/m².yr 45.81
Plug Loads EUI kWh/ft².yr 1.59
MJ/m².yr 61.77

FOOD SERVICE EQUIPMENT

Provide description below:

	Gas EUI	Electric EUI
EUI kWh/ft².yr	2.1	1.5
MJ/m².yr	80.0	60.0

REFRIGERATION

Provide description below:

Commercial refrigeration display cases

EUI kWh/ft².yr 31.0
MJ/m².yr 1200.0

MISCELLANEOUS

Provide description below:

	Gas EUI	Electric EUI
EUI kWh/ft².yr	0.5	1.5
MJ/m².yr	20.0	60.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **Food Retail** **Baseline**

SIZE:

VINTAGE:

REGION: **Inland South**

SPACE HEATING

Heating Plant Type

							Electric			Other	
				Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	5%	2%	2%	56%	25%	0%	5%		5%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff.) (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	31.5 W/m²	10.0 Btu/hr.ft²	
Seasonal Heating Load (Tertiary Load)	280 MJ/m².yr	7.2 kWh/ft².yr	
Sizing Factor	1.00		
Electric Fuel Share	10.0%	Fossil Fuel Share	90.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	5.7
MJ/m².yr	222

Gas EUI	
kWh/ft².yr	9.4
MJ/m².yr	365

Market Composite EUI	
kWh/ft².yr	9.0
MJ/m².yr	350

SPACE COOLING

A/C Plant Type

			WSHP			Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	0.0%	0.0%	0.0%	10.0%	90.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7 °C	44.6 °F
Condenser Water	30 °C	86 °F
Supply Air	14.0 °C	57.2 °F

Peak Cooling Load	123 W/m²	39 Btu/hr.ft²	308 ft²/Ton
Seasonal Cooling Load (Tertiary Load)	187.3 MJ/m².yr	4.8 kWh/ft².yr	

Sizing Factor 1.00 Operation (occ. period) 3000 hrs/year Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C) 60.0%

Electric Fuel Share 100.0% Gas Fuel Share 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	1.8
MJ/m².yr	70

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	1.8
MJ/m².yr	70

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	60%				5%
Eff./COP	0.65				0.75

	Fossil		Elec. Res.
Fuel Share	65%		35%
Blended Efficiency	0.66		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 70.0

Wetting Use Percentage 90%

All Electric EUI	
kWh/ft².yr	2.0
MJ/m².yr	77

Fossil Fuel EUI	
kWh/ft².yr	2.7
MJ/m².yr	106

Market Composite EUI	
kWh/ft².yr	2.5
MJ/m².yr	96.1

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **SIZE:** **VINTAGE:** **REGION:**
Food Retail **Inland South**
Baseline

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	5.6	L/s.m²	1.09	CFM/ft²
System Static Pressure CAV	500	Pa	2.0	wg
System Static Pressure VAV	1000	Pa	4.0	wg
Fan Efficiency	60%			
Fan Motor Efficiency	80%			
Sizing Factor	1.00			
Fan Design Load CAV	5.8	W/m²	0.54	W/ft²
Fan Design Load VAV	11.6	W/m²	1.07	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	100%	0%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	60%	40%	100%	0%

Comments:

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m²	0.01	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.2	L/s.m²	0.03	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.2	W/m²	0.02	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.024	kW/kW	0.08	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	2.89	W/m²	0.27	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.007	L/s.m²	0.010	U.S. gpm/ft²
Pump Head Pressure	0	kPa	0	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.00	W/m²	0.00	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.005	L/s.m²	0.0078	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	1.1	W/m²	0.10	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	38.5	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	1.8	kWh/m².yr
Condenser Pump Energy Consumption	0.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	1.0	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	5.3	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI	kWh/ft².yr	4.3
	MJ/m².yr	167.6

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **SIZE:** **VINTAGE:** **REGION:**
Food Retail **Inland South**
Baseline

EUI SUMMARY

TOTAL ALL END-USES: **Electricity:** **59.4** kWh/ft².yr **2,299.4** MJ/m².yr **Fossil Fue** **12.8** kWh/ft².yr **497.3** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	5.1	197.3
ARCHITECTURAL LIGHTING	2.4	93.3
SPECIAL PURPOSE LIGHTING	6.9	267.6
OTHER PLUG LOADS	1.6	61.8
HVAC FANS & PUMPS	4.3	167.6
REFRIGERATION	31.0	1,200.0
COMPUTER EQUIPMENT	1.2	45.8
ELEVATORS	0.1	3.9
OUTDOOR LIGHTING	1.3	50.9

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.6	22.2	8.5	328.1
SPACE COOLING	1.1	42.0	0.0	0.0
DOMESTIC HOT WATER	0.7	26.9	1.8	69.2
FOOD SERVICE EQUIPMENT	1.5	60.0	2.1	80.0
MISCELLANEOUS	1.5	60.0	0.5	20.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **SIZE:** **VINTAGE:** **REGION:**
Large Hotel **Inland South**
Baseline

CONSTRUCTION

Wall U value (W/m².°C)	0.82	W/m².°C	0.14	Btu/hr.ft² . °F	Typical Building Size	20,000	m²	215,200	ft²
Roof U value (W/m².°C)	0.61	W/m².°C	0.11	Btu/hr.ft² . °F	Typical Footprint (m²)	2,000	m²	21,520	ft²
Glazing U value (W/m².°C)	4.30	W/m².°C	0.76	Btu/hr.ft² . °F	Footprint Aspect Ratio (L:W)	3			
					Percent Conditioned Space	100%			
					Percent Conditioned Space Defined as Exterior Zone	45%			
Window/Wall Ratio (WIWAR) (%)	0.30								
Shading Coefficient (SC)	0.65				Typical # Stories	10			
					Floor to Floor Height (m)	3.7	m	12.0	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	80%		0%		20%		0%		100%
Min. Air Flow (%)					60%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	50	m²/person	538	ft²/person	%OA	22.62%
Occupancy Schedule Occ. Period	50%					
Occupancy Schedule Unocc. Period	80%					
Fresh Air Requirements or Outside Air	80	L/s.person	170	CFM/person		

Fresh Air Control Type *(enter a 1, 2 or 3) | 1 | If Fresh Air Control Type = "2" enter % FA. to the right: | 15%
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air) | If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation | 0.5 L/s.m² | 0.10 CFM/ft²
50% operation (%)

Sizing Factor	2.25			
Total Air Circulation or Design Air Flow	7.07	L/s.m²	1.39	CFM/ft²
Infiltration Rate	0.70	L/s.m²	0.14	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based	Total
Incidence of Use	0%		100%	100%
Switchover Point		KJ/kg.	18	°C
		Btu/lbm	64.4	°F

Summary of Design Parameters		
Peak Design Cooling Load	9,191,351	
Peak Zone Sensible Load	2,864,284	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	133,246	
Total air circulation or Design air	7.07	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	23	°C	73.4	°F	15	°C	59	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	20.8	°C	69.44	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Hotel			Inland South
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	290	Lux	27.0	ft-candles
Floor Fraction (GLFF)	0.25			
Connected Load	8.2	W/m²	0.8	W/ft²
Occ. Period(Hrs./yr.)	3000			
Unocc. Period(Hrs./yr.)	5760			
Usage During Occupied Period	85%			
Usage During Unoccupied Period	90%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	200	300	400	500	Total
% Distribution	50%	20%	20%	10%	100%
Weighted Average					**290**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			50.0%		50.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI		
EUI	kWh/ft².yr	1.5
	MJ/m².yr	57

ARCHITECTURAL LIGHTING

Light Level	220	Lux	20.4	ft-candles
Floor Fraction (ALFF)	0.75			
Connected Load	21.0	W/m²	1.9	W/ft²
Occ. Period(Hrs./yr.)	2500			
Unocc. Period(Hrs./yr.)	6260			
Usage During Occupied Period	60%			
Usage During Unoccupied Period	40%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	100	200	300	400	Total
% Distribution	20%	50%	20%	10%	100%
Weighted Average					**220**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	50%	50%					0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI		
EUI	kWh/ft².yr	5.8
	MJ/m².yr	227

SPECIAL PURPOSE LIGHTING

Light Level	0.00	Lux	0.0	ft-candles
Floor Fraction (HBLFF)	0.00			
Connected Load	0.0	W/m²	0.0	W/ft²
Occ. Period(Hrs./yr.)	4000			
Unocc. Period(Hrs./yr.)	4760			
Usage During Occupied Period	0%			
Usage During Unoccupied Period	100%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 | 1.00

Light Level (Lux)	300	500	700	1000	Total
% Distribution		0%	0%	0%	0%
Weighted Average					**0**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)								0.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI		
EUI	kWh/ft².yr	0.0
	MJ/m².yr	0

TOTAL LIGHTING	Overall LPD	17.77 W/m²	EUI TOTAL	kWh/ft².yr	7.3
		1.65 W/ft²		MJ/m².yr	284

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Servers	Plug Loads
Measured Power (W/device)	55	51	100	200	217	
Density (device/occupant)	0.3	0.3	0.05	0.033	0.03	
Connected Load	0.3 W/m²	0.3 W/m²	0.1 W/m²	0.1 W/m²	0.5 W/m²	2.1 W/m²
	0.0 W/ft²	0.0 W/ft²	0.01 W/ft²	0.01 W/ft²	0.05 W/ft²	0.20 W/ft²
Diversity Occupied Period	90%	90%	90%	90%	100%	70%
Diversity Unoccupied Period	50%	50%	50%	50%	100%	25%
Operation Occ. Period (hrs./year)	2500	2500	2500	2500	2500	3000
Operation Unocc. Period (hrs./year)	6260	6260	6260	6260	6260	5760

Total end-use load (occupied period)	2.8	W/m²	0.3	W/ft²
Total end-use load (unocc. period)	1.5	W/m²	0.1	W/ft²
Usage during occupied period	100%			
Usage during unoccupied period	53%			

Computer Equipment	EUI	kWh/ft².yr	0.85
		MJ/m².yr	32.93
Plug Loads	EUI	kWh/ft².yr	0.69
		MJ/m².yr	26.76

FOOD SERVICE EQUIPMENT

Provide description below:

Kitchen

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	2.6	EUI	kWh/ft².yr	0.5
	MJ/m².yr	100.0		MJ/m².yr	20.0

REFRIGERATION

Provide description below:

Walk-in coolers/freezers, reach-in coolers/freezers, refrigerated buffet cases

EUI	kWh/ft².yr	0.8
	MJ/m².yr	30.0

MISCELLANEOUS

Provide description below:

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	1.5	EUI	kWh/ft².yr	0.0
	MJ/m².yr	60.0		MJ/m².yr	0.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: Large Hotel, Baseline
SIZE:
VINTAGE:
REGION: Inland South

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	42%	20%	5%	18%	0%	0%	5%	2%	8%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff.) (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load: 34.5 W/m² — 11.0 Btu/hr.ft²
Seasonal Heating Load (Tertiary Load): 319 MJ/m².yr — 8.2 kWh/ft².yr
Sizing Factor: 1.00

Electric Fuel Share: 15.0% — Fossil Fuel Share: 85.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	6.4
MJ/m².yr	247

Gas EUI	
kWh/ft².yr	10.7
MJ/m².yr	415

Market Composite EUI	
kWh/ft².yr	10.1
MJ/m².yr	390

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	45.0%	25.0%	0.0%	0.0%	30.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

	°C	°F
Chilled Water	7	44.6
Condenser Water	30	86
Supply Air	15.0	59

Peak Cooling Load: 121 W/m² — 38 Btu/hr.ft² — 312 ft²/Ton
Seasonal Cooling Load (Tertiary Load): 200.1 MJ/m².yr — 5.2 kWh/ft².yr

Sizing Factor: 0.90 — Operation (occ. period): 3000 hrs/year — Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C): 80.0%

Electric Fuel Share: 100.0% — Gas Fuel Share: 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	1.9
MJ/m².yr	72

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	1.9
MJ/m².yr	72

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	20%				70%
Eff./COP	0.65				0.75

	Fossil	Elec. Res.
Fuel Share	90%	10%
Blended Efficiency	0.73	0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load): 236.6

Wetting Use Percentage: 90%

All Electric EUI	
kWh/ft².yr	6.7
MJ/m².yr	260

Fossil Fuel EUI	
kWh/ft².yr	8.4
MJ/m².yr	325

Market Composite EUI	
kWh/ft².yr	8.2
MJ/m².yr	318.6

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **SIZE:** **VINTAGE:** **REGION:**
Large Hotel **Inland South**
Baseline

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	7.1	L/s.m²	1.39	CFM/ft²
System Static Pressure CAV	500	Pa	2.0	wg
System Static Pressure VAV	750	Pa	3.0	wg
Fan Efficiency	55%			
Fan Motor Efficiency	80%			
Sizing Factor	1.00			
Fan Design Load CAV	8.0	W/m²	0.75	W/ft²
Fan Design Load VAV	12.1	W/m²	1.12	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	80%	20%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	50%	50%	100%	0%

Comments:

EXHAUST FANS

Washroom Exhaust	550	L/s.washroom	1165	CFM/washroom
Washroom Exhaust per gross unit are	0.6	L/s.m²	0.11	CFM/ft²
Other Exhaust (Smoking/Conference)	0.5	L/s.m²	0.10	CFM/ft²
Total Building Exhaust	1.1	L/s.m²	0.21	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	50%			
Fan Motor Efficiency	80%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.7	W/m²	0.06	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.023	kW/kW	0.08	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	2.76	W/m²	0.26	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.006	L/s.m²	0.009	U.S. gpm/ft²
Pump Head Pressure	100	kPa	33.333333	ft
Pump Efficiency	55%			
Pump Motor Efficiency	85%			
Sizing Factor	1.0			
Pump Connected Load	1.37	W/m²	0.13	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.005	L/s.m²	0.0077	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	85%					
Sizing Factor	0.8					
Pump Connected Load	1.0	W/m²	0.09	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	49.8	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	5.7	kWh/m².yr
Condenser Pump Energy Consumption	3.1	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	1.1	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	4.9	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI	kWh/ft².yr	6.0
	MJ/m².yr	232.8

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Large Hotel			**Inland South**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES: **Electricity:** **20.0** kWh/ft².yr **775.6** MJ/m².yr **Fossil Fuel** **20.8** kWh/ft².yr **805.4** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	1.5	57.2
ARCHITECTURAL LIGHTING	5.8	226.5
SPECIAL PURPOSE LIGHTING	0.0	0.0
OTHER PLUG LOADS	0.7	26.8
HVAC FANS & PUMPS	6.0	232.8
REFRIGERATION	0.8	30.0
COMPUTER EQUIPMENT	0.9	32.9
ELEVATORS	0.3	11.6
OUTDOOR LIGHTING	0.4	17.0

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	1.0	37.0	9.1	352.8
SPACE COOLING	1.5	57.8	0.0	0.0
DOMESTIC HOT WATER	0.7	26.0	7.6	292.6
FOOD SERVICE EQUIPMENT	0.5	20.0	2.6	100.0
MISCELLANEOUS	0.0	0.0	1.5	60.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Medium Hotel	**50,000 to 100,000 ft²**		**Inland South**
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.82	W/m².°C	0.14	Btu/hr.ft².°F	Typical Building Size	6,000	m²	64,560	ft²
Roof U value (W/m².°C)	0.56	W/m².°C	0.10	Btu/hr.ft².°F	Typical Footprint (m²)	1,500	m²	16,140	ft²
Glazing U value (W/m².°C)	4.30	W/m².°C	0.76	Btu/hr.ft².°F	Footprint Aspect Ratio (L:W)	4			
					Percent Conditioned Space	100%			
					Percent Conditioned Space Defined as Exterior Zone	45%			
Window/Wall Ratio (WIWAR) (%)	0.28								
Shading Coefficient (SC)	0.57				Typical # Stories	4			
					Floor to Floor Height (m)	3.7	m	12.0	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	90%		0%		10%		0%		100%
Min. Air Flow (%)					60%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	46	m²/person	495	ft²/person	%OA	11.19%
Occupancy Schedule Occ. Period	50%					
Occupancy Schedule Unocc. Period	80%					
Fresh Air Requirements or Outside Air	25	L/s.person	53	CFM/person		

Fresh Air Control Type *(enter a 1, 2 or 3)	1	If Fresh Air Control Type = "2" enter % FA. to the right:	15%			
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)		If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation	0.5	L/s.m²	0.10	CFM/ft²
			50%	operation (%)		

Sizing Factor	1.4			
Total Air Circulation or Design Air Flow	4.86	L/s.m²	0.96	CFM/ft²
Infiltration Rate	1.00	L/s.m²	0.20	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	1,604,007	
Peak Zone Sensible Load	947,831	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	44,093	
Total air circulation or Design air	4.86	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	22	°C	71.6	°F	13	°C	55.4	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	21	°C	69.8	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning — Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Hotel	50,000 to 100,000 ft²		Inland South
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	125	Lux	11.6	ft-candles
Floor Fraction (GLFF)	0.20			
Connected Load	3.5	W/m²	0.3	W/ft²
Occ. Period(Hrs./yr.)	3400			
Unocc. Period(Hrs./yr.)	5360			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	40%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	125	300	700	1000				Total
% Distribution	100%	0%	0%	0%				100%
Weighted Average								**125**
	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			50.0%		50.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	0.4
	MJ/m².yr	14

ARCHITECTURAL LIGHTING

Light Level	160	Lux	14.9	ft-candles
Floor Fraction (ALFF)	0.80			
Connected Load	16.9	W/m²	1.6	W/ft²
Occ. Period(Hrs./yr.)	2300			
Unocc. Period(Hrs./yr.)	6460			
Usage During Occupied Period	65%			
Usage During Unoccupied Period	50%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	100	125	150	300				Total
% Distribution	20%	40%	20%	20%				100%
Weighted Average								**160**
	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	60%	40%					0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	5.9
	MJ/m².yr	230

SPECIAL PURPOSE LIGHTING

Light Level	0.00	Lux	0.0	ft-candles
Floor Fraction (HBLFF)	0.00			
Connected Load	0.0	W/m²	0.0	W/ft²
Occ. Period(Hrs./yr.)	4000			
Unocc. Period(Hrs./yr.)	4760			
Usage During Occupied Period	0%			
Usage During Unoccupied Period	100%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 | 1.00

Light Level (Lux)	300	500	700	1000				Total
% Distribution		0%	0%	0%				0%
Weighted Average								**0**
	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)								0.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	0.0
	MJ/m².yr	0

TOTAL LIGHTING

Overall LPD	14.21 W/m²	EUI TOTAL	kWh/ft².yr	6.3
	1.32 W/ft²		MJ/m².yr	243

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Servers		Plug Loads	
Measured Power (W/device)	55		51		100		200		217			
Density (device/occupant)	0.3		0.3		0.05		0.033		0.02			
Connected Load	0.4	W/m²	0.3	W/m²	0.1	W/m²	0.1	W/m²	0.5	W/m²	2.05	W/m²
	0.0	W/ft²	0.0	W/ft²	0.01	W/ft²	0.01	W/ft²	0.05	W/ft²	0.19	W/ft²
Diversity Occupied Period	90%		90%		90%		90%		100%		70%	
Diversity Unoccupied Period	50%		50%		50%		50%		100%		25%	
Operation Occ. Period (hrs./year)	2500		2500		2500		2500		2500		3000	
Operation Unocc. Period (hrs./year)	6260		6260		6260		6260		6260		5760	

Total end-use load (occupied period)	2.8	W/m²	0.3	W/ft²
Total end-use load (unocc. period)	1.5	W/m²	0.1	W/ft²
Usage during occupied period	100%			
Usage during unoccupied period	54%			

Computer Equipment	EUI	kWh/ft².yr	0.89
		MJ/m².yr	34.38
Plug Loads	EUI	kWh/ft².yr	0.67
		MJ/m².yr	26.13

FOOD SERVICE EQUIPMENT

Provide description below:

Kitchen services

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	1.5	EUI	kWh/ft².yr	0.5
	MJ/m².yr	60.0		MJ/m².yr	20.0

REFRIGERATION

Provide description below:

Walk-in coolers/freezers, reach-in coolers/freezers, refrigerated buffet cases

EUI	kWh/ft².yr	0.8
	MJ/m².yr	30.0

MISCELLANEOUS

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	1.5	EUI	kWh/ft².yr	0.0
	MJ/m².yr	60.0		MJ/m².yr	0.0

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Hotel	50,000 to 100,000 ft²		Inland South
Baseline			

SPACE HEATING

Heating Plant Type

							Electric			Other	
				Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	15%	10%	5%	30%	0%	0%	2%		38%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff.) (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	48.2	W/m²	15.3	Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	416	MJ/m².yr	10.7	kWh/ft².yr
Sizing Factor	1.00			
Electric Fuel Share	40.0%	Fossil Fuel Share	60.0%	

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	10.5
MJ/m².yr	407

Gas EUI	
kWh/ft².yr	14.0
MJ/m².yr	541

Market Composite EUI	
kWh/ft².yr	12.6
MJ/m².yr	487

SPACE COOLING

A/C Plant Type

			WSHP			Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	0.0%	0.0%	15.0%	15.0%	70.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7	°C	44.6	°F
Condenser Water	30	°C	86	°F
Supply Air	13.0	°C	55.4	°F

Peak Cooling Load	67	W/m²	21	Btu/hr.ft²	568	ft²/Ton
Seasonal Cooling Load (Tertiary Load)	156.8	MJ/m².yr	4.0	kWh/ft².yr		

Sizing Factor 0.85 | Operation (occ. period) 3000 hrs/year | Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C) 50.0%

Electric Fuel Share 100.0% | Gas Fuel Share 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	1.6
MJ/m².yr	62

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	1.6
MJ/m².yr	62

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	40%				30%
Eff./COP	0.65				0.75

	Fossil		Elec. Res.
Fuel Share	70%		30%
Blended Efficiency	0.69		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 236.6

Wetting Use Percentage 90%

All Electric EUI	
kWh/ft².yr	6.7
MJ/m².yr	260

Fossil Fuel EUI	
kWh/ft².yr	8.8
MJ/m².yr	341

Market Composite EUI	
kWh/ft².yr	8.2
MJ/m².yr	317.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Hotel	50,000 to 100,000 ft²		Inland South
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	4.9	L/s.m²	0.96	CFM/ft²
System Static Pressure CAV	337.5	Pa	1.4	wg
System Static Pressure VAV	531.25	Pa	2.1	wg
Fan Efficiency	45%			
Fan Motor Efficiency	80%			
Sizing Factor	1.00			
Fan Design Load CAV	4.6	W/m²	0.42	W/ft²
Fan Design Load VAV	7.2	W/m²	0.67	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	90%	10%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	50%	50%	100%	0%
Comments:				

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m²	0.03	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.2	L/s.m²	0.05	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.3	W/m²	0.03	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.027	kW/kW	0.09	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	1.80	W/m²	0.17	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.004	L/s.m²	0.005	U.S. gpm/ft²
Pump Head Pressure	0	kPa	0	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.00	W/m²	0.00	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.003	L/s.m²	0.0042	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.6	W/m²	0.05	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	28.2	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	2.7	kWh/m².yr
Condenser Pump Energy Consumption	0.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	1.0	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	2.9	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI	kWh/ft².yr	3.2
	MJ/m².yr	125.3

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Medium Hotel	**50,000 to 100,000 ft²**		**Inland South**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**19.7** kWh/ft².yr	**762.5** MJ/m².yr	**Fossil Fuel** **17.6** kWh/ft².yr	**683.4** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr	**END USE:**	Electricity kWh/ft².yr	Electricity MJ/m².yr	Fossil Fuel kWh/ft².yr	Fossil Fuel MJ/m².yr
GENERAL LIGHTING	0.4	13.7					
ARCHITECTURAL LIGHTING	5.9	229.7	SPACE HEATING	4.2	162.8	8.4	324.3
SPECIAL PURPOSE LIGHTING	0.0	0.0	SPACE COOLING	0.8	30.9	0.0	0.0
OTHER PLUG LOADS	0.7	26.1	DOMESTIC HOT WATER	2.0	78.0	6.2	239.0
HVAC FANS & PUMPS	3.2	125.3	FOOD SERVICE EQUIPMENT	0.5	20.0	1.5	60.0
REFRIGERATION	0.8	30.0	MISCELLANEOUS	0.0	0.0	1.5	60.0
COMPUTER EQUIPMENT	0.9	34.4					
ELEVATORS	0.3	11.6					
OUTDOOR LIGHTING	0.0	0.0					

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **Hospital** **Baseline** | **SIZE:** | **VINTAGE:** | **REGION:** **Inland South**

CONSTRUCTION

Wall U value (W/m².°C)	0.67	W/m².°C	0.12	Btu/hr.ft². °F	Typical Building Size	14,000	m²	150,640	ft²
Roof U value (W/m².°C)	0.58	W/m².°C	0.10	Btu/hr.ft². °F	Typical Footprint (m²)	1,750	m²	18,830	ft²
Glazing U value (W/m².°C)	4.30	W/m².°C	0.76	Btu/hr.ft². °F	Footprint Aspect Ratio (L:W)	2			
					Percent Conditioned Space	100%			
					Percent Conditioned Space Defined as Exterior Zone	45%			
Window/Wall Ratio (WIWAR) (%)	0.15								
Shading Coefficient (SC)	0.65				Typical # Stories	8			
					Floor to Floor Height (m)	4.3	m	14.0	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	50%		0%		50%		0%		100%
Min. Air Flow (%)					60%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	30	m²/person	323	ft²/person	%OA	38.44%
Occupancy Schedule Occ. Period	90%					
Occupancy Schedule Unocc. Period	75%					
Fresh Air Requirements or Outside Air	75	L/s.person	159	CFM/person		

Fresh Air Control Type *(enter a 1, 2 or 3) | 1 | If Fresh Air Control Type = "2" enter % FA. to the right: | 15%
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air) | If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation | 0.5 L/s.m² | 0.10 CFM/ft² | 50% operation (%)

Sizing Factor	2			
Total Air Circulation or Design Air Flow	6.50	L/s.m²	1.28	CFM/ft²
Infiltration Rate	0.70	L/s.m²	0.14	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	9,044,996	
Peak Zone Sensible Load	2,073,447	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	96,457	
Total air circulation or Design air	6.50	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	24	°C	75.2	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	23	°C	73.4	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	23	°C	73.4	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning — Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Hospital			Inland South
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	475	Lux	44.1	ft-candles
Floor Fraction (GLFF)	0.75			
Connected Load	13.1	W/m²	1.2	W/ft²
Occ. Period(Hrs./yr.)	3200			
Unocc. Period(Hrs./yr.)	5560			
Usage During Occupied Period	80%			
Usage During Unoccupied Period	35%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	100	250	700	800	Total
% Distribution		50%	50%	0%	100%
Weighted Average					**475**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			33.0%		67.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	4.1
	MJ/m².yr	159

ARCHITECTURAL LIGHTING

Light Level	340	Lux	31.6	ft-candles
Floor Fraction (ALFF)	0.25			
Connected Load	32.4	W/m²	3.0	W/ft²
Occ. Period(Hrs./yr.)	2500			
Unocc. Period(Hrs./yr.)	6260			
Usage During Occupied Period	80%			
Usage During Unoccupied Period	35%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	100	250	700	800	Total
% Distribution		80%	20%	0%	100%
Weighted Average					**340**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	50%	50%						100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	3.2
	MJ/m².yr	122

SPECIAL PURPOSE LIGHTING

Light Level	0.00	Lux	0.0	ft-candles
Floor Fraction (HBLFF)	0.00			
Connected Load	0.0	W/m²	0.0	W/ft²
Occ. Period(Hrs./yr.)	4000			
Unocc. Period(Hrs./yr.)	4760			
Usage During Occupied Period	0%			
Usage During Unoccupied Period	100%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 | 1.00

Light Level (Lux)	300	500	700	1000	Total
% Distribution		0%	0%	0%	0%
Weighted Average					**0**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)								0.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	0.0
	MJ/m².yr	0

TOTAL LIGHTING

Overall LPD	17.89 W/m²	EUI TOTAL	kWh/ft².yr	7.3
	1.66 W/ft²		MJ/m².yr	281

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Servers	Plug Loads
Measured Power (W/device)	55	51	100	200	217	
Density (device/occupant)	0.477744	0.477744	0.02	0.02	0.04	
Connected Load	0.9 W/m²	0.8 W/m²	0.1 W/m²	0.1 W/m²	0.5 W/m²	3.85 W/m²
	0.1 W/ft²	0.1 W/ft²	0.01 W/ft²	0.01 W/ft²	0.05 W/ft²	0.36 W/ft²
Diversity Occupied Period	90%	90%	90%	90%	100%	90%
Diversity Unoccupied Period	50%	50%	50%	50%	100%	25%
Operation Occ. Period (hrs./year)	2000	2000	2600	2600	2600	4100
Operation Unocc. Period (hrs./year)	6760	6760	6160	6160	6160	4660

Total end-use load (occupied period)	5.7 W/m²	0.5 W/ft²
Total end-use load (unocc. period)	2.4 W/m²	0.2 W/ft²
Usage during occupied period	100%	
Usage during unoccupied period	43%	

Computer Equipment	EUI	kWh/ft².yr	1.33
		MJ/m².yr	51.37
Plug Loads	EUI	kWh/ft².yr	1.74
		MJ/m².yr	67.29

FOOD SERVICE EQUIPMENT

Provide description below:

Commercial food services

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	1.8	EUI	kWh/ft².yr	1.3
	MJ/m².yr	70.0		MJ/m².yr	50.0

REFRIGERATION

Provide description below:

Walk-in coolers/freezers, reach-in coolers/freezers, refrigerated buffet cases

EUI	kWh/ft².yr	0.4
	MJ/m².yr	15.0

MISCELLANEOUS

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	6.5	EUI	kWh/ft².yr	0.0
	MJ/m².yr	250.0		MJ/m².yr	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Hospital			**Inland South**
Baseline			

SPACE HEATING

Heating Plant Type

							Electric			Other	
				Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	10%	75%	0%	10%	0%	0%	1%	0%	4%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff. (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	22.5	W/m²	7.1	Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	972	MJ/m².yr	25.1	kWh/ft².yr
Sizing Factor	1.00			
Electric Fuel Share	5.0%	Fossil Fuel Share	95.0%	

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	23.0
MJ/m².yr	892

Gas EUI	
kWh/ft².yr	31.8
MJ/m².yr	1232

Market Composite EUI	
kWh/ft².yr	31.4
MJ/m².yr	1215

SPACE COOLING

A/C Plant Type

			WSHP			Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	60.0%	20.0%	0.0%	15.0%	5.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7	°C	44.6	°F
Condenser Water	30	°C	86	°F
Supply Air	14.0	°C	57.2	°F

Peak Cooling Load	189	W/m²	60	Btu/hr.ft²	200	ft²/Ton
Seasonal Cooling Load (Tertiary Load)	214.1	MJ/m².yr	5.5	kWh/ft².yr		

Sizing Factor 1.00 — Operation (occ. period) 3000 hrs/year Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C) 85.0%

Electric Fuel Share 100.0% — Gas Fuel Share 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenan

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	2.5
MJ/m².yr	99

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	2.5
MJ/m².yr	99

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	10%				80%
Eff./COP	0.65				0.80

	Fossil		Elec. Res.
Fuel Share	90%		10%
Blended Efficiency	0.78		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 250.0

Wetting Use Percentage 90%

All Electric EUI	
kWh/ft².yr	7.1
MJ/m².yr	275

Fossil Fuel EUI	
kWh/ft².yr	8.2
MJ/m².yr	319

Market Composite EUI	
kWh/ft².yr	8.1
MJ/m².yr	314.7

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: Hospital Baseline | **SIZE:** | **VINTAGE:** | **REGION:** Inland South

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	6.5	L/s.m²	1.28	CFM/ft²
System Static Pressure CAV	875	Pa	3.5	wg
System Static Pressure VAV	838	Pa	3.4	wg
Fan Efficiency	52%			
Fan Motor Efficiency	85%			
Sizing Factor	1.00			
Fan Design Load CAV	12.9	W/m²	1.20	W/ft²
Fan Design Load VAV	12.3	W/m²	1.15	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	50%	50%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	80%	20%	100%	0%
Comments:				

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m²	0.02	CFM/ft²
Other Exhaust (Smoking/Conference)	0.5	L/s.m²	0.10	CFM/ft²
Total Building Exhaust	0.6	L/s.m²	0.12	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.8	W/m²	0.08	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.020	kW/kW	0.07	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	3.79	W/m²	0.35	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.010	L/s.m²	0.015	U.S. gpm/ft²
Pump Head Pressure	100	kPa	33.333333	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	2.51	W/m²	0.23	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.008	L/s.m²	0.0120	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	1.6	W/m²	0.15	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	82.6	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	7.2	kWh/m².yr
Condenser Pump Energy Consumption	6.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	1.1	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	8.2	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI		
	kWh/ft².yr	9.8
	MJ/m².yr	377.9

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: Hospital Baseline
SIZE:
VINTAGE:
REGION: Inland South

EUI SUMMARY

TOTAL ALL END-USES: **Electricity:** **27.0** kWh/ft².yr **1,044.2** MJ/m².yr **Fossil Fuel** **45.9** kWh/ft².yr **1,778.0** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	4.1	158.9
ARCHITECTURAL LIGHTING	3.2	122.1
SPECIAL PURPOSE LIGHTING	0.0	0.0
OTHER PLUG LOADS	1.7	67.3
HVAC FANS & PUMPS	9.8	377.9
REFRIGERATION	0.4	15.0
COMPUTER EQUIPMENT	1.3	51.4
ELEVATORS	0.3	11.6
OUTDOOR LIGHTING	0.9	33.9

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	1.2	44.6	30.2	1,170.7
SPACE COOLING	2.2	83.9	0.0	0.0
DOMESTIC HOT WATER	0.7	27.5	7.4	287.2
FOOD SERVICE EQUIPMENT	1.3	50.0	1.8	70.0
MISCELLANEOUS	0.0	0.0	6.5	250.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Nursing Home	50,000 to 100,000 ft²		Inland South
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.67 W/m².°C	0.12 Btu/hr.ft² . °F	Typical Building Size	5,600 m²	60,256 ft²
Roof U value (W/m².°C)	0.56 W/m².°C	0.10 Btu/hr.ft² . °F	Typical Footprint (m²)	2,800 m²	30,128 ft²
Glazing U value (W/m².°C)	4.57 W/m².°C	0.80 Btu/hr.ft² . °F	Footprint Aspect Ratio (L:W)	7	
			Percent Conditioned Space	100%	
			Percent Conditioned Space Defined as Exterior Zone	45%	
Window/Wall Ratio (WIWAR) (%)	0.28				
Shading Coefficient (SC)	0.60		Typical # Stories	2	
			Floor to Floor Height (m)	3.7 m	12.0 ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	90%		0%		10%	0%	0%		100%
Min. Air Flow (%)					60%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	30 m²/person	323 ft²/person	%OA 26.44%
Occupancy Schedule Occ. Period	100%		
Occupancy Schedule Unocc. Period	95%		
Fresh Air Requirements or Outside Air	38 L/s.person	81 CFM/person	

Fresh Air Control Type *(enter a 1, 2 or 3) 1
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right: 15%
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation 0.5 L/s.m² 0.10 CFM/ft²
50% operation (%)

Sizing Factor	1.3	
Total Air Circulation or Design Air Flow	4.79 L/s.m²	0.94 CFM/ft²

Separate Make-up air unit (100% OA) 0 L/s.m² 0.00 CFM/ft²
Operation occupied period 50%
Operation unoccupied period 50%

Infiltration Rate 0.30 L/s.m² 0.06 CFM/ft²
(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	2,378,601	
Peak Zone Sensible Load	939,806	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	43,720	
Total air circulation or Design air	4.79	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	23	°C	73.4	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	23	°C	73.4	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	23	°C	73.4	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Nursing Home	50,000 to 100,000 ft²		Inland South
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	267	Lux	24.8	ft-candles
Floor Fraction (GLFF)	0.70			
Connected Load	7.3	W/m²	0.7	W/ft²
Occ. Period(Hrs./yr.)	3400			
Unocc. Period(Hrs./yr.)	5360			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	20%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	200	300	500	1000				Total
% Distribution	33%	67%	0%	0%				100%
Weighted Average								**267**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			33.0%		67.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	2.1
	MJ/m².yr	80

ARCHITECTURAL LIGHTING

Light Level	233	Lux	21.7	ft-candles
Floor Fraction (ALFF)	0.30			
Connected Load	24.6	W/m²	2.3	W/ft²
Occ. Period(Hrs./yr.)	3400			
Unocc. Period(Hrs./yr.)	5360			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	30%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	200	300	400	500				Total
% Distribution	67%	33%	0%	0%				100%
Weighted Average								**233**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	60%	40%					0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	3.3
	MJ/m².yr	128

SPECIAL PURPOSE LIGHTING

Light Level	0.00	Lux	0.0	ft-candles
Floor Fraction (HBLFF)	0.00			
Connected Load	0.0	W/m²	0.0	W/ft²
Occ. Period(Hrs./yr.)	4000			
Unocc. Period(Hrs./yr.)	4760			
Usage During Occupied Period	0%			
Usage During Unoccupied Period	100%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 | 1.00

Light Level (Lux)	300	500	700	1000				Total
% Distribution		0%	0%	0%				0%
Weighted Average								**0**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)								0.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	0.0
	MJ/m².yr	0

TOTAL LIGHTING

Overall LPD	12.51 W/m²	EUI TOTAL	kWh/ft².yr	5.4
	1.16 W/ft²		MJ/m².yr	208

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Servers		Plug Loads	
Measured Power (W/device)	55		51		100		200		217			
Density (device/occupant)	0.477744		0.477744		0.02		0.02		0.04			
Connected Load	0.9	W/m²	0.8	W/m²	0.1	W/m²	0.1	W/m²	0.5	W/m²	1.35	W/m²
	0.1	W/ft²	0.1	W/ft²	0.01	W/ft²	0.01	W/ft²	0.05	W/ft²	0.13	W/ft²
Diversity Occupied Period	90%		90%		90%		90%		100%		90%	
Diversity Unoccupied Period	50%		50%		50%		50%		100%		25%	
Operation Occ. Period (hrs./year)	2000		2000		2600		2600		2600		4100	
Operation Unocc. Period (hrs./year)	6760		6760		6160		6160		6160		4660	

Total end-use load (occupied period)	3.4	W/m²	0.3	W/ft²
Total end-use load (unocc. period)	1.8	W/m²	0.2	W/ft²
Usage during occupied period	100%			
Usage during unoccupied period	52%			

Computer Equipment	EUI	kWh/ft².yr	1.33
		MJ/m².yr	51.37
Plug Loads	EUI	kWh/ft².yr	0.61
		MJ/m².yr	23.60

FOOD SERVICE EQUIPMENT

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	1.5	EUI	kWh/ft².yr	1.3
	MJ/m².yr	60.0		MJ/m².yr	50.0

REFRIGERATION

Provide description below:

Walk-in coolers/freezers, reach-in coolers/freezers, refrigerated buffet cases

EUI	kWh/ft².yr	0.8
	MJ/m².yr	30.0

MISCELLANEOUS

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	1.8	EUI	kWh/ft².yr	0.0
	MJ/m².yr	70.0		MJ/m².yr	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Nursing Home	50,000 to 100,000 ft²		Inland South
Baseline			

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	35%	35%	5%	10%	5%	0%	5%	0%	5%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff.) (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	35.6	W/m²	11.3	Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	369	MJ/m².yr	9.5	kWh/ft².yr
Sizing Factor	1.00			

Electric Fuel Share 10.0% Fossil Fuel Share 90.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	7.6
MJ/m².yr	293

Gas EUI	
kWh/ft².yr	12.2
MJ/m².yr	474

Market Composite EUI	
kWh/ft².yr	11.8
MJ/m².yr	456

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	0.0%	0.0%	0.0%	15.0%	85.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7	°C	44.6	°F
Condenser Water	30	°C	86	°F
Supply Air	14.0	°C	57.2	°F

Peak Cooling Load	106	W/m²	34	Btu/hr.ft²	358	ft²/Ton
Seasonal Cooling Load (Tertiary Load)	170.6	MJ/m².yr	4.4	kWh/ft².yr		

Sizing Factor 0.85 Operation (occ. period) 3000 hrs/year Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C) 30.0%

Electric Fuel Share 100.0% Gas Fuel Share 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	1.9
MJ/m².yr	72

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	1.9
MJ/m².yr	72

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	10%				60%
Eff./COP	0.65				0.75

	Fossil		Elec. Res.
Fuel Share	70%		30%
Blended Efficiency	0.74		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 175.0

Wetting Use Percentage 90%

All Electric EUI	
kWh/ft².yr	5.0
MJ/m².yr	192

Fossil Fuel EUI	
kWh/ft².yr	6.1
MJ/m².yr	238

Market Composite EUI	
kWh/ft².yr	5.8
MJ/m².yr	224.2

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Nursing Home	**50,000 to 100,000 ft²**		**Inland South**
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	4.8	L/s.m²	0.94	CFM/ft²
System Static Pressure CAV	500	Pa	2.0	wg
System Static Pressure VAV	500	Pa	2.0	wg
Fan Efficiency	52%			
Fan Motor Efficiency	75%			
Sizing Factor	1.00			
Fan Design Load CAV	6.1	W/m²	0.57	W/ft²
Fan Design Load VAV	6.1	W/m²	0.57	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	90%	10%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	80%	20%	100%	0%
Comments:				

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m²	0.01	CFM/ft²
Other Exhaust (Smoking/Conference)	0.5	L/s.m²	0.10	CFM/ft²
Total Building Exhaust	0.6	L/s.m²	0.11	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.8	W/m²	0.07	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.020	kW/kW	0.07	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	2.12	W/m²	0.20	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.006	L/s.m²	0.008	U.S. gpm/ft²
Pump Head Pressure	0	kPa	0	ft
Pump Efficiency	55%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.00	W/m²	0.00	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.005	L/s.m²	0.0067	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	55%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.8	W/m²	0.08	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	45.9	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	6.7	kWh/m².yr
Condenser Pump Energy Consumption	0.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.9	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	4.1	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI	kWh/ft².yr	5.4
	MJ/m².yr	207.4

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: Nursing Home Baseline

SIZE: 50,000 to 100,000 ft²

VINTAGE:

REGION: Inland South

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**18.7** kWh/ft².yr	**724.7** MJ/m².yr	**Fossil Fue**	**18.7** kWh/ft².yr	**723.1** MJ/m².yr	

END USE:	kWh/ft².yr	MJ/m².yr	**END USE:**	Electricity		Fossil Fuel	
				kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	2.1	79.6					
ARCHITECTURAL LIGHTING	3.3	128.4	SPACE HEATING	0.8	29.3	11.0	426.6
SPECIAL PURPOSE LIGHTING	0.0	0.0	SPACE COOLING	0.6	21.7	0.0	0.0
OTHER PLUG LOADS	0.6	23.6	DOMESTIC HOT WATER	1.5	57.7	4.3	166.5
HVAC FANS & PUMPS	5.4	207.4	FOOD SERVICE EQUIPMENT	1.3	50.0	1.5	60.0
REFRIGERATION	0.8	30.0	MISCELLANEOUS	0.0	0.0	1.8	70.0
COMPUTER EQUIPMENT	1.3	51.4					
ELEVATORS	0.3	11.6					
OUTDOOR LIGHTING	0.9	33.9					

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Large Schools	**> 50,000 ft2**		**Inland South**
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.64	W/m².°C	0.11	Btu/hr.ft² . °F
Roof U value (W/m².°C)	0.61	W/m².°C	0.11	Btu/hr.ft² . °F
Glazing U value (W/m².°C)	4.57	W/m².°C	0.80	Btu/hr.ft² . °F
Window/Wall Ratio (WIWAR) (%)	0.13			
Shading Coefficient (SC)	0.65			

Typical Building Size	9,300	m²	100,068	ft²
Typical Footprint (m²)	4,650	m²	50,034	ft²
Footprint Aspect Ratio (L:W)	5			
Percent Conditioned Space	100%			
Percent Conditioned Space Defined as Exterior Zone	37%			
Typical # Stories	2			
Floor to Floor Height (m)	4.0	m	13.2	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	90%		0%		10%		0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	10	m²/person	108	ft²/person
Occupancy Schedule Occ. Period	90%			
Occupancy Schedule Unocc. Period	0%			
Fresh Air Requirements or Outside Air	9	L/s.person	19	CFM/person

%OA 20.45%

Fresh Air Control Type *(enter a 1, 2 or 3) 1
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right: 34%
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation 0.5 L/s.m² 0.10 CFM/ft²
50% operation (%)

Sizing Factor	1.5			
Total Air Circulation or Design Air Flow	4.40	L/s.m²	0.87	CFM/ft²
Infiltration Rate	0.42	L/s.m²	0.08	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	3,097,906	
Peak Zone Sensible Load	1,242,887	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	57,819	
Total air circulation or Design air	4.40	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	23	°C	73.4	°F	13	°C	55.4	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	20.4	°C	68.72	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Schools	> 50,000 ft2		Inland South
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	440	Lux	40.9	ft-candles
Floor Fraction (GLFF)	0.89			
Connected Load	12.1	W/m²	1.1	W/ft²
Occ. Period(Hrs./yr.)	3000			
Unocc. Period(Hrs./yr.)	5760			
Usage During Occupied Period	85%			
Usage During Unoccupied Period	25%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	300	500	700	1000				Total
% Distribution	40%	50%	10%	0%				100%
Weighted Average								**440**
	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			35.0%		65.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	4.0
	MJ/m².yr	155

ARCHITECTURAL LIGHTING

Light Level	400	Lux	37.2	ft-candles
Floor Fraction (ALFF)	0.01			
Connected Load	27.8	W/m²	2.6	W/ft²
Occ. Period(Hrs./yr.)	3000			
Unocc. Period(Hrs./yr.)	5760			
Usage During Occupied Period	90%			
Usage During Unoccupied Period	75%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	300	500	700	1000				Total
% Distribution	50%	50%	0%	0%				100%
Weighted Average								**400**
	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	25%	75%						100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	0.2
	MJ/m².yr	7

SPECIAL PURPOSE LIGHTING

Light Level	300.00	Lux	27.9	ft-candles
Floor Fraction (HBLFF)	0.10			
Connected Load	14.0	W/m²	1.3	W/ft²
Occ. Period(Hrs./yr.)	3000			
Unocc. Period(Hrs./yr.)	5760			
Usage During Occupied Period	100%			
Usage During Unoccupied Period	25%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 — 1.00

Light Level (Lux)	300	500	700	1000				Total
% Distribution	100%	0%	0%	0%				100%
Weighted Average								**300**
	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)						100%		100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	0.6
	MJ/m².yr	22

TOTAL LIGHTING

Overall LPD	12.48 W/m²	EUI TOTAL	kWh/ft².yr	4.8
	1.16 W/ft²		MJ/m².yr	185

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Servers		Plug Loads	
Measured Power (W/device)	55		51		100		200		217			
Density (device/occupant)	0.222732		0.222732		0.02		0.02		0.01			
Connected Load	1.2	W/m²	1.1	W/m²	0.2	W/m²	0.4	W/m²	0.5	W/m²	0.25	W/m²
	0.1	W/ft²	0.1	W/ft²	0.02	W/ft²	0.04	W/ft²	0.05	W/ft²	0.02	W/ft²
Diversity Occupied Period	90%		90%		90%		90%		100%		100%	
Diversity Unoccupied Period	25%		25%		25%		25%		100%		0%	
Operation Occ. Period (hrs./year)	2000		2000		2000		2000		2600		3000	
Operation Unocc. Period (hrs./year)	6760		6760		6760		6760		6160		5760	

Total end-use load (occupied period)	3.4	W/m²	0.3	W/ft²
Total end-use load (unocc. period)	1.3	W/m²	0.1	W/ft²
Usage during occupied period	100%			
Usage during unoccupied period	37%			

Computer Equipment	EUI	kWh/ft².yr	1.37
		MJ/m².yr	53.21
Plug Loads	EUI	kWh/ft².yr	0.07
		MJ/m².yr	2.70

FOOD SERVICE EQUIPMENT

Provide description below:

Cafeteria

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	0.5	EUI	kWh/ft².yr	0.1
	MJ/m².yr	20.0		MJ/m².yr	5.0

REFRIGERATION

Provide description below:

EUI	kWh/ft².yr	0.1
	MJ/m².yr	2.1

MISCELLANEOUS

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	0.1	EUI	kWh/ft².yr	0.0
	MJ/m².yr	5.0		MJ/m².yr	0.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Schools	> 50,000 ft2		Inland South
Baseline			

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	45%	20%	7%	10%	12%	0%	3%	0%	3%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff. (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	29.1 W/m²	9.2 Btu/hr.ft²	
Seasonal Heating Load (Tertiary Load)	265 MJ/m².yr	6.8 kWh/ft².yr	
Sizing Factor	1.00		
Electric Fuel Share	6.0%	Fossil Fuel Share	94.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	5.4
MJ/m².yr	211
Gas EUI	
kWh/ft².yr	8.8
MJ/m².yr	342
Market Composite EUI	
kWh/ft².yr	8.6
MJ/m².yr	334

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	0.0%	0.0%	0.0%	15.0%	85.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7 °C	44.6 °F
Condenser Water	30 °C	86 °F
Supply Air	13.0 °C	55.4 °F

Peak Cooling Load	98 W/m²	31 Btu/hr.ft²	388 ft²/Ton
Seasonal Cooling Load (Tertiary Load)	129.2 MJ/m².yr	3.3 kWh/ft².yr	
Sizing Factor	1.00	Operation (occ. period)	3000 hrs/year Note value cannot be less than 2,900 hrs/year)
A/C Saturation (Incidence of A/C)	10.0%		
Electric Fuel Share	100.0%	Gas Fuel Share	0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenan

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	1.3
MJ/m².yr	50
Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0
Market Composite EUI	
kWh/ft².yr	1.3
MJ/m².yr	50

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	45%				25%
Eff./COP	0.65				0.75

	Fossil	Elec. Res.
Fuel Share	70%	30%
Blended Efficiency	0.69	0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load): 40.0

Wetting Use Percentage: 90%

	All Electric EUI	Fossil Fuel EUI	Market Composite EUI
kWh/ft².yr	1.1	1.5	1.4
MJ/m².yr	44	58	54.0

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **Large Schools** **Baseline**
SIZE: **> 50,000 ft2**
VINTAGE:
REGION: **Inland South**

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	4.4	L/s.m²	0.87	CFM/ft²
System Static Pressure CAV	500	Pa	2.0	wg
System Static Pressure VAV	500	Pa	2.0	wg
Fan Efficiency	60%			
Fan Motor Efficiency	88%			
Sizing Factor	1.00			
Fan Design Load CAV	4.2	W/m²	0.39	W/ft²
Fan Design Load VAV	4.2	W/m²	0.39	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	90%	10%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	40%	60%	50%	50%
Comments:				

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.0	L/s.m²	0.01	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.1	L/s.m²	0.03	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.2	W/m²	0.02	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.020	kW/kW	0.07	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	1.95	W/m²	0.18	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.005	L/s.m²	0.008	U.S. gpm/ft²
Pump Head Pressure	0	kPa	0	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.00	W/m²	0.00	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.004	L/s.m²	0.0062	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.8	W/m²	0.08	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	22.5	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	1.2	kWh/m².yr
Condenser Pump Energy Consumption	0.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.6	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	4.2	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI		
	kWh/ft².yr	2.6
	MJ/m².yr	102.5

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Large Schools	**> 50,000 ft2**		**Inland South**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**10.4** kWh/ft².yr	**401.8** MJ/m².yr	**Fossil Fue**	**10.0** kWh/ft².yr	**387.0** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	4.0	155.2
ARCHITECTURAL LIGHTING	0.2	7.0
SPECIAL PURPOSE LIGHTING	0.6	22.4
OTHER PLUG LOADS	0.1	2.7
HVAC FANS & PUMPS	2.6	102.5
REFRIGERATION	0.1	2.1
COMPUTER EQUIPMENT	1.4	53.2
ELEVATORS	0.1	3.9
OUTDOOR LIGHTING	0.4	17.0

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.3	12.6	8.3	321.2
SPACE COOLING	0.1	5.0	0.0	0.0
DOMESTIC HOT WATER	0.3	13.2	1.1	40.8
FOOD SERVICE EQUIPMENT	0.1	5.0	0.5	20.0
MISCELLANEOUS	0.0	0.0	0.1	5.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Schools	< 50,000 ft2		Inland South
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.64	W/m².°C	0.11	Btu/hr.ft² . °F	Typical Building Size	2,300	m²	24,748	ft²
Roof U value (W/m².°C)	0.61	W/m².°C	0.11	Btu/hr.ft² . °F	Typical Footprint (m²)	2,300	m²	24,748	ft²
Glazing U value (W/m².°C)	4.57	W/m².°C	0.80	Btu/hr.ft² . °F	Footprint Aspect Ratio (L:W)	5			
					Percent Conditioned Space	100%			
					Percent Conditioned Space Defined as Exterior Zone	50%			
Window/Wall Ratio (WIWAR) (%)	0.13								
Shading Coefficient (SC)	0.65				Typical # Stories	1			
					Floor to Floor Height (m)	4.0	m	13.2	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	100%		0%		0%		0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	10	m²/person	108	ft²/person	%OA	15.08%
Occupancy Schedule Occ. Period	90%					
Occupancy Schedule Unocc. Period	0%					
Fresh Air Requirements or Outside Air	8	L/s.person	16	CFM/person		

Fresh Air Control Type *(enter a 1, 2 or 3) | 1 | If Fresh Air Control Type = "2" enter % FA. to the right: 34%
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air) | If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation: 0.5 L/s.m² | 0.10 CFM/ft² | 50% operation (%)

Sizing Factor	1.3			
Total Air Circulation or Design Air Flow	4.97	L/s.m²	0.98	CFM/ft²
Infiltration Rate	0.42	L/s.m²	0.08	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	791,839	
Peak Zone Sensible Load	400,735	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	18,642	
Total air circulation or Design air	4.97	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	21	°C	69.8	°F	13	°C	55.4	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	20.4	°C	68.72	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Schools	< 50,000 ft2		Inland South
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	400	Lux	37.2	ft-candles
Floor Fraction (GLFF)	0.89			
Connected Load	11.0	W/m²	1.0	W/ft²
Occ. Period(Hrs./yr.)	2400			
Unocc. Period(Hrs./yr.)	6360			
Usage During Occupied Period	85%			
Usage During Unoccupied Period	25%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	300	500	700	1000			Total
% Distribution	50%	50%	0%	0%			100%
Weighted Average							**400**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			35.0%		65.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	3.3
	MJ/m².yr	128

ARCHITECTURAL LIGHTING

Light Level	400	Lux	37.2	ft-candles
Floor Fraction (ALFF)	0.01			
Connected Load	27.8	W/m²	2.6	W/ft²
Occ. Period(Hrs./yr.)	2400			
Unocc. Period(Hrs./yr.)	6360			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	30%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	300	500	700	1000			Total
% Distribution	50%	50%	0%	0%			100%
Weighted Average							**400**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	25%	75%						100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	0.1
	MJ/m².yr	4

SPECIAL PURPOSE LIGHTING

Light Level	300.00	Lux	27.9	ft-candles
Floor Fraction (HBLFF)	0.10			
Connected Load	14.0	W/m²	1.3	W/ft²
Occ. Period(Hrs./yr.)	4000			
Unocc. Period(Hrs./yr.)	4760			
Usage During Occupied Period	100%			
Usage During Unoccupied Period	10%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 | 1.00

Light Level (Lux)	300	500	700	1000			Total
% Distribution	100%	0%	0%	0%			100%
Weighted Average							**300**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)						100%		100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	0.6
	MJ/m².yr	23

TOTAL LIGHTING

Overall LPD	10.10 W/m²	EUI TOTAL	kWh/ft².yr	4.0
	0.94 W/ft²		MJ/m².yr	155

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Servers		Plug Loads	
Measured Power (W/device)	55		51		100		200		217			
Density (device/occupant)	0.05		0.05		0.02		0.02		0.01			
Connected Load	0.3	W/m²	0.3	W/m²	0.2	W/m²	0.4	W/m²	0.5	W/m²	0.2	W/m²
	0.0	W/ft²	0.0	W/ft²	0.02	W/ft²	0.04	W/ft²	0.05	W/ft²	0.02	W/ft²
Diversity Occupied Period	90%		90%		90%		90%		100%		100%	
Diversity Unoccupied Period	25%		25%		25%		25%		100%		0%	
Operation Occ. Period (hrs./year)	2900		2900		2600		2600		2600		3000	
Operation Unocc. Period (hrs./year)	5860		5860		6160		6160		6160		5760	

Total end-use load (occupied period)	1.7	W/m²	0.2	W/ft²
Total end-use load (unocc. period)	0.8	W/m²	0.1	W/ft²
Usage during occupied period	100%			
Usage during unoccupied period	46%			

Computer Equipment	EUI	kWh/ft².yr	0.83
		MJ/m².yr	32.30
Plug Loads	EUI	kWh/ft².yr	0.06
		MJ/m².yr	2.16

FOOD SERVICE EQUIPMENT

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	0.3	EUI	kWh/ft².yr	0.2
	MJ/m².yr	10.0		MJ/m².yr	8.0

REFRIGERATION

Provide description below:

EUI	kWh/ft².yr	0.0
	MJ/m².yr	1.1

MISCELLANEOUS

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	0.1	EUI	kWh/ft².yr	1.2
	MJ/m².yr	5.0		MJ/m².yr	45.0

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EXISTING BUILDINGS: **SIZE:** **VINTAGE:** **REGION:**

Medium Schools **< 50,000 ft2** **Inland South**

Baseline

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	45%	20%	7%	10%	12%	0%	3%	0%	3%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff.) (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	39.5 W/m²	12.5 Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	356 MJ/m².yr	9.2 kWh/ft².yr
Sizing Factor	1.00	
Electric Fuel Share	6.0%	Fossil Fuel Share 94.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	7.3
MJ/m².yr	282

Gas EUI	
kWh/ft².yr	11.8
MJ/m².yr	458

Market Composite EUI	
kWh/ft².yr	11.6
MJ/m².yr	448

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7 °C	44.6 °F
Condenser Water	30 °C	86 °F
Supply Air	13.0 °C	55.4 °F

Peak Cooling Load	101 W/m²	32 Btu/hr.ft²	375 ft²/Ton
Seasonal Cooling Load (Tertiary Load)	134.2 MJ/m².yr	3.5 kWh/ft².yr	

Sizing Factor 1.00 Operation (occ. period) 3000 hrs/year Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C) 10.0%

Electric Fuel Share 100.0% Gas Fuel Share 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	1.4
MJ/m².yr	55

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	1.4
MJ/m².yr	55

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	45%				25%
Eff./COP	0.65				0.75

	Fossil		Elec. Res.
Fuel Share	70%		30%
Blended Efficiency	0.69		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 40.0

Wetting Use Percentage 90%

All Electric EUI	
kWh/ft².yr	1.1
MJ/m².yr	44

Fossil Fuel EUI	
kWh/ft².yr	1.5
MJ/m².yr	58

Market Composite EUI	
kWh/ft².yr	1.4
MJ/m².yr	54.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Medium Schools	**< 50,000 ft2**		**Inland South**
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	5.0	L/s.m²	0.98	CFM/ft²
System Static Pressure CAV	250	Pa	1.0	wg
System Static Pressure VAV	250	Pa	1.0	wg
Fan Efficiency	60%			
Fan Motor Efficiency	88%			
Sizing Factor	1.00			
Fan Design Load CAV	2.4	W/m²	0.22	W/ft²
Fan Design Load VAV	2.4	W/m²	0.22	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	65%	35%	50%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	65%	35%	50%	50%
Comments:				

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m²	0.02	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.2	L/s.m²	0.04	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.2	W/m²	0.02	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.020	kW/kW	0.07	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	2.02	W/m²	0.19	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.005	L/s.m²	0.008	U.S. gpm/ft²
Pump Head Pressure	0	kPa	0	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.00	W/m²	0.00	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.004	L/s.m²	0.0064	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.9	W/m²	0.08	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	14.1	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	1.5	kWh/m².yr
Condenser Pump Energy Consumption	0.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.7	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	4.3	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI	kWh/ft².yr	1.9
	MJ/m².yr	74.5

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Medium Schools	**< 50,000 ft2**		**Inland South**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**9.6** kWh/ft².yr	**372.7** MJ/m².yr	**Fossil Fuel**	**12.6** kWh/ft².yr	**486.5** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr	**END USE:**	Electricity kWh/ft².yr	Electricity MJ/m².yr	Fossil Fuel kWh/ft².yr	Fossil Fuel MJ/m².yr
GENERAL LIGHTING	3.3	128.4					
ARCHITECTURAL LIGHTING	0.1	4.2	SPACE HEATING	0.4	16.9	11.1	430.7
SPECIAL PURPOSE LIGHTING	0.6	22.5	SPACE COOLING	0.1	5.5	0.0	0.0
OTHER PLUG LOADS	0.1	2.2	DOMESTIC HOT WATER	0.3	13.2	1.1	40.8
HVAC FANS & PUMPS	1.9	74.5	FOOD SERVICE EQUIPMENT	0.2	8.0	0.3	10.0
REFRIGERATION	0.0	1.1	MISCELLANEOUS	1.2	45.0	0.1	5.0
COMPUTER EQUIPMENT	0.8	32.3					
ELEVATORS	0.1	1.9					
OUTDOOR LIGHTING	0.4	17.0					

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
University-Colleges			**Inland South**
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.75	W/m².°C	0.13	Btu/hr.ft².°F	Typical Building Size	9,000	m²	96,840	ft²
Roof U value (W/m².°C)	0.61	W/m².°C	0.11	Btu/hr.ft².°F	Typical Footprint (m²)	3,000	m²	32,280	ft²
Glazing U value (W/m².°C)	4.56	W/m².°C	0.80	Btu/hr.ft².°F	Footprint Aspect Ratio (L:W)	7			
					Percent Conditioned Space	100%			
					Percent Conditioned Space Defined as Exterior Zone	50%			
Window/Wall Ratio (WIWAR) (%)	0.30								
Shading Coefficient (SC)	0.65				Typical # Stories	3			
					Floor to Floor Height (m)	3.7	m	12.0	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	70%		0%		30%		0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	14	m²/person	151	ft²/person	%OA	16.26%
Occupancy Schedule Occ. Period	90%					
Occupancy Schedule Unocc. Period	0%					
Fresh Air Requirements or Outside Air	15	L/s.person	32	CFM/person		

Fresh Air Control Type *(enter a 1, 2 or 3) | 1 | If Fresh Air Control Type = "2" enter % FA. to the right: | 34%

(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air) | If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation | 0.5 L/s.m² | 0.10 CFM/ft² | 50% operation (%)

Sizing Factor	1.6			
Total Air Circulation or Design Air Flow	6.59	L/s.m²	1.30	CFM/ft²
Infiltration Rate	0.70	L/s.m²	0.14	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	3,726,861	
Peak Zone Sensible Load	1,688,099	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	78,530	
Total air circulation or Design air	6.59	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	24	°C	75.2	°F	13	°C	55.4	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	16	°C	60.8	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	20.4	°C	68.72	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning — Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **SIZE:** **VINTAGE:** **REGION:**
University-Colleges **Inland South**
Baseline

LIGHTING

GENERAL LIGHTING

Light Level	610	Lux	56.7	ft-candles
Floor Fraction (GLFF)	0.93			
Connected Load	16.8	W/m²	1.6	W/ft²
Occ. Period(Hrs./yr.)	4100			
Unocc. Period(Hrs./yr.)	4660			
Usage During Occupied Period	90%			
Usage During Unoccupied Period	20%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	300	500	700	1000				Total
% Distribution	10%	25%	65%	0%				100%
Weighted Average								**610**
	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			35.0%	0%	65.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI kWh/ft².yr 6.7
MJ/m².yr 260

ARCHITECTURAL LIGHTING

Light Level	300	Lux	27.9	ft-candles
Floor Fraction (ALFF)	0.03			
Connected Load	28.6	W/m²	2.7	W/ft²
Occ. Period(Hrs./yr.)	4100			
Unocc. Period(Hrs./yr.)	4660			
Usage During Occupied Period	100%			
Usage During Unoccupied Period	50%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	300	500	700	1000				Total
% Distribution	100%	0%	0%	0%				100%
Weighted Average								**300**
	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	50%	50%					0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI kWh/ft².yr 0.5
MJ/m².yr 20

SPECIAL PURPOSE LIGHTING

Light Level	640.00	Lux	59.5	ft-candles
Floor Fraction (HBLFF)	0.04			
Connected Load	29.8	W/m²	2.8	W/ft²
Occ. Period(Hrs./yr.)	4100			
Unocc. Period(Hrs./yr.)	4660			
Usage During Occupied Period	90%			
Usage During Unoccupied Period	20%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 1.00

Light Level (Lux)	300	500	700	1000				Total
% Distribution	0%	30%	70%	0%				100%
Weighted Average								**640**
	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)						100%		100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI kWh/ft².yr 0.5
MJ/m².yr 20

TOTAL LIGHTING

Overall LPD 16.51 W/m² 1.53 W/ft²

EUI TOTAL kWh/ft².yr 7.7
MJ/m².yr 300

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Servers	Plug Loads
Measured Power (W/device)	55	51	100	200	217	
Density (device/occupant)	0.311825	0.311825	0.02	0.02	0.01	
Connected Load	1.2 W/m²	1.1 W/m²	0.1 W/m²	0.3 W/m²	0.5 W/m²	1.3 W/m²
	0.1 W/ft²	0.1 W/ft²	0.01 W/ft²	0.03 W/ft²	0.05 W/ft²	0.12 W/ft²
Diversity Occupied Period	90%	90%	90%	90%	100%	100%
Diversity Unoccupied Period	50%	50%	50%	50%	100%	20%
Operation Occ. Period (hrs./year)	2000	2000	2600	2600	2600	2000
Operation Unocc. Period (hrs./year)	6760	6760	6160	6160	6160	6760

Total end-use load (occupied period)	4.3 W/m²	0.4 W/ft²
Total end-use load (unocc. period)	2.2 W/m²	0.2 W/ft²

Usage during occupied period 100%
Usage during unoccupied period 50%

Computer Equipment EUI kWh/ft².yr 1.76
MJ/m².yr 68.30

Plug Loads EUI kWh/ft².yr 0.40
MJ/m².yr 15.69

FOOD SERVICE EQUIPMENT

Provide description below:

	Gas EUI		Electric EUI	
EUI	kWh/ft².yr	1.0	kWh/ft².yr	0.3
	MJ/m².yr	40.0	MJ/m².yr	10.0

REFRIGERATION

Provide description below:

EUI kWh/ft².yr 0.5
MJ/m².yr 20.0

MISCELLANEOUS

Provide description below:

	Gas EUI		Electric EUI	
EUI	kWh/ft².yr	1.8	kWh/ft².yr	0.0
	MJ/m².yr	70.0	MJ/m².yr	0.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **SIZE:** **VINTAGE:** **REGION:**
University-Colleges **Inland South**
Baseline

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	20%	60%	5%	10%	0%	0%	2%	0%	3%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff. (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	42.1 W/m²	13.3 Btu/hr.ft²	
Seasonal Heating Load (Tertiary Load)	357 MJ/m².yr	9.2 kWh/ft².yr	
Sizing Factor	1.00		
Electric Fuel Share	5.0%	Fossil Fuel Share	95.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	7.7
MJ/m².yr	298

Gas EUI	
kWh/ft².yr	11.7
MJ/m².yr	453

Market Composite EUI	
kWh/ft².yr	11.5
MJ/m².yr	445

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	20.0%	5.0%	0.0%	0.0%	75.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7 °C	44.6 °F
Condenser Water	30 °C	86 °F
Supply Air	13.0 °C	55.4 °F

Peak Cooling Load	121 W/m²	38 Btu/hr.ft²	312 ft²/Ton
Seasonal Cooling Load (Tertiary Load)	208.4 MJ/m².yr	5.4 kWh/ft².yr	

Sizing Factor 1.00 Operation (occ. period) 3000 hrs/year Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C) 10.0%

Electric Fuel Share 100.0% Gas Fuel Share 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenan

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	2.1
MJ/m².yr	83

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	2.1
MJ/m².yr	83

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	10%				75%
Eff./COP	0.65				0.75

	Fossil		Elec. Res.
Fuel Share	85%		15%
Blended Efficiency	0.74		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 65.0

Wetting Use Percentage 90%

All Electric EUI	
kWh/ft².yr	1.8
MJ/m².yr	71

Fossil Fuel EUI	
kWh/ft².yr	2.3
MJ/m².yr	88

Market Composite EUI	
kWh/ft².yr	2.2
MJ/m².yr	85.6

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
University-Colleges			Inland South
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	6.6	L/s.m²	1.30	CFM/ft²
System Static Pressure CAV	1000	Pa	4.0	wg
System Static Pressure VAV	1000	Pa	4.0	wg
Fan Efficiency	60%			
Fan Motor Efficiency	80%			
Sizing Factor	1.00			
Fan Design Load CAV	13.7	W/m²	1.28	W/ft²
Fan Design Load VAV	13.7	W/m²	1.28	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	70%	30%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	50%	50%	100%	0%
Comments:				

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m²	0.01	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.2	L/s.m²	0.03	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.2	W/m²	0.02	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.027	kW/kW	0.09	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	3.28	W/m²	0.30	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.006	L/s.m²	0.009	U.S. gpm/ft²
Pump Head Pressure	0	kPa	0	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.00	W/m²	0.00	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.005	L/s.m²	0.0077	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	1.0	W/m²	0.10	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	74.6	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	1.9	kWh/m².yr
Condenser Pump Energy Consumption	0.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	1.4	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	5.2	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI		
	kWh/ft².yr	7.7
	MJ/m².yr	299.7

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
University-Colleges			**Inland South**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES: **Electricity:** **20.0** kWh/ft².yr **776.3** MJ/m².yr **Fossil Fuel** **15.9** kWh/ft².yr **615.1** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	6.7	260.5
ARCHITECTURAL LIGHTING	0.5	19.8
SPECIAL PURPOSE LIGHTING	0.5	19.9
OTHER PLUG LOADS	0.4	15.7
HVAC FANS & PUMPS	7.7	299.7
REFRIGERATION	0.5	20.0
COMPUTER EQUIPMENT	1.8	68.3
ELEVATORS	0.3	11.6
OUTDOOR LIGHTING	0.4	17.0

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.4	14.9	11.1	430.3
SPACE COOLING	0.2	8.3	0.0	0.0
DOMESTIC HOT WATER	0.3	10.7	1.9	74.8
FOOD SERVICE EQUIPMENT	0.3	10.0	1.0	40.0
MISCELLANEOUS	0.0	0.0	1.8	70.0

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **SIZE:** **VINTAGE:** **REGION:**
Restaurant **Inland South**
Baseline

CONSTRUCTION

Wall U value (W/m².°C)	0.59 W/m².°C	0.10 Btu/hr.ft² . °F	Typical Building Size	1,225 m²	13,181 ft²
Roof U value (W/m².°C)	0.53 W/m².°C	0.09 Btu/hr.ft² . °F	Typical Footprint (m²)	1,225 m²	13,181 ft²
Glazing U value (W/m².°C)	4.43 W/m².°C	0.78 Btu/hr.ft² . °F	Footprint Aspect Ratio (L:W)	1	
			Percent Conditioned Space	100%	
			Percent Conditioned Space Defined as Exterior Zone	40%	
Window/Wall Ratio (WIWAR) (%)	0.18				
Shading Coefficient (SC)	0.69		Typical # Stories	1	
			Floor to Floor Height (m)	4.6 m	15.0 ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	100%		0%		0%		0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	20 m²/person	215 ft²/person	%OA 22.49%
Occupancy Schedule Occ. Period	90%		
Occupancy Schedule Unocc. Period	0%		
Fresh Air Requirements or Outside Air	33 L/s.person	70 CFM/person	

Fresh Air Control Type *(enter a 1, 2 or 3) 1
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right: 0%
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation 0.5 L/s.m² 0.10 CFM/ft²
50% operation (%)

Sizing Factor	1.4	
Total Air Circulation or Design Air Flow	7.34 L/s.m²	1.44 CFM/ft²
Infiltration Rate	0.70 L/s.m²	0.14 CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0 L/s.m²	0.00 CFM/ft²
Operation occupied period	50%	
Operation unoccupied period	50%	

Economizer

	Enthalpy Based		Dry-Bulb Based	Total
Incidence of Use	0%		100%	100%
Switchover Point		KJ/kg.	18 °C	
		Btu/lbm	64.4 °F	

Summary of Design Parameters		
Peak Design Cooling Load	702,885	
Peak Zone Sensible Load	292,406	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	13,603	
Total air circulation or Design air	7.34	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	22	°C	71.6	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	21	°C	69.8	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Restaurant			Inland South
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	400	Lux	37.1	ft-candles
Floor Fraction (GLFF)	0.20			
Connected Load	11.7	W/m²	1.1	W/ft²
Occ. Period(Hrs./yr.)	3400			
Unocc. Period(Hrs./yr.)	5360			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	20%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	300	400	500	1000	Total
% Distribution	33%	33%	33%	0%	100%
Weighted Average					**399.6**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			66.0%	0%	34.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	0.9
	MJ/m².yr	36

ARCHITECTURAL LIGHTING

Light Level	250	Lux	23.2	ft-candles
Floor Fraction (ALFF)	0.80			
Connected Load	32.8	W/m²	3.0	W/ft²
Occ. Period(Hrs./yr.)	3400			
Unocc. Period(Hrs./yr.)	5360			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	30%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	100	200	300	400	Total
% Distribution	10%	40%	40%	10%	100%
Weighted Average					**250**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	85%	15%					0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI	kWh/ft².yr	11.8
	MJ/m².yr	457

EUI = Load X Hrs. X SF X GLFF

SPECIAL PURPOSE LIGHTING

Light Level	0.00	Lux	0.0	ft-candles
Floor Fraction (HBLFF)	0.00			
Connected Load	0.0	W/m²	0.0	W/ft²
Occ. Period(Hrs./yr.)	4000			
Unocc. Period(Hrs./yr.)	4760			
Usage During Occupied Period	0%			
Usage During Unoccupied Period	100%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 | 1.00

Light Level (Lux)	300	500	700	1000	Total
% Distribution		0%	0%	0%	0%
Weighted Average					**0**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)								0.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	0.0
	MJ/m².yr	0

TOTAL LIGHTING

Overall LPD	28.56 W/m²	EUI TOTAL	kWh/ft².yr	12.7
	2.65 W/ft²		MJ/m².yr	493

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Servers	Plug Loads
Measured Power (W/device)	55	51	100	200	217	
Density (device/occupant)	0.1614	0.1614	0.01	0.01	0.01	
Connected Load	0.4 W/m²	0.4 W/m²	0.1 W/m²	0.1 W/m²	0.5 W/m²	3.2 W/m²
	0.0 W/ft²	0.0 W/ft²	0.00 W/ft²	0.01 W/ft²	0.05 W/ft²	0.30 W/ft²
Diversity Occupied Period	90%	90%	90%	90%	100%	90%
Diversity Unoccupied Period	50%	50%	50%	50%	100%	90%
Operation Occ. Period (hrs./year)	2000	2000	2600	2600	2600	4100
Operation Unocc. Period (hrs./year)	6760	6760	6160	6160	6160	4660

Total end-use load (occupied period)	4.3 W/m²	0.4 W/ft²
Total end-use load (unocc. period)	3.9 W/m²	0.4 W/ft²
Usage during occupied period	100%	
Usage during unoccupied period	91%	

Computer Equipment	EUI	kWh/ft².yr	0.90
		MJ/m².yr	34.97
Plug Loads	EUI	kWh/ft².yr	2.34
		MJ/m².yr	90.82

FOOD SERVICE EQUIPMENT

Provide description below:

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	23.2	EUI	kWh/ft².yr	8.5
	MJ/m².yr	900.0		MJ/m².yr	330.0

REFRIGERATION

Provide description below:

EUI	kWh/ft².yr	16.8
	MJ/m².yr	650.0

MISCELLANEOUS

Provide description below:

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	0.5	EUI	kWh/ft².yr	0.0
	MJ/m².yr	20.0		MJ/m².yr	0.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Restaurant			Inland South
Baseline			

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	2%	1%	1%	48%	35%	0%	1%	2%	10%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff.) (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	40.0 W/m²	12.7 Btu/hr.ft²	
Seasonal Heating Load (Tertiary Load)	375 MJ/m².yr	9.7 kWh/ft².yr	
Sizing Factor	1.00		
Electric Fuel Share	13.0%	Fossil Fuel Share	87.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	8.4
MJ/m².yr	324

Gas EUI	
kWh/ft².yr	12.5
MJ/m².yr	486

Market Composite EUI	
kWh/ft².yr	12.0
MJ/m².yr	465

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	0.0%	0.0%	0.0%	10.0%	90.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7 °C	44.6 °F
Condenser Water	30 °C	86 °F
Supply Air	14.0 °C	57.2 °F

Peak Cooling Load	202 W/m²	64 Btu/hr.ft²	188 ft²/Ton
Seasonal Cooling Load (Tertiary Load)	252.1 MJ/m².yr	6.5 kWh/ft².yr	

Sizing Factor: 1.20 — Operation (occ. period): 3000 hrs/year — Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C): 70.0%

Electric Fuel Share: 100.0% — Gas Fuel Share: 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	2.8
MJ/m².yr	110

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	2.8
MJ/m².yr	110

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	30%				30%
Eff./COP	0.65				0.75

	Fossil		Elec. Res.
Fuel Share	60%		40%
Blended Efficiency	0.70		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load): 600.0

Wetting Use Percentage: 10%

All Electric EUI	
kWh/ft².yr	17.0
MJ/m².yr	659

Fossil Fuel EUI	
kWh/ft².yr	22.1
MJ/m².yr	857

Market Composite EUI	
kWh/ft².yr	20.1
MJ/m².yr	778.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **SIZE:** **VINTAGE:** **REGION:**
Restaurant **Inland South**
Baseline

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	7.3	L/s.m²	1.44	CFM/ft²
System Static Pressure CAV	500	Pa	2.0	wg
System Static Pressure VAV	500	Pa	2.0	wg
Fan Efficiency	60%			
Fan Motor Efficiency	80%			
Sizing Factor	1.00			
Fan Design Load CAV	7.6	W/m²	0.71	W/ft²
Fan Design Load VAV	7.6	W/m²	0.71	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	100%	0%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	80%	20%	100%	0%
Comments:				

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.2	L/s.m²	0.03	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.3	L/s.m²	0.05	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.4	W/m²	0.03	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.020	kW/kW	0.07	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	4.03	W/m²	0.37	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.011	L/s.m²	0.016	U.S. gpm/ft²
Pump Head Pressure	0	kPa	0	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.00	W/m²	0.00	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.009	L/s.m²	0.0128	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	0	kPa	0	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.0	W/m²	0.00	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	58.9	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	3.1	kWh/m².yr
Condenser Pump Energy Consumption	0.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	1.3	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	0.0	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI	kWh/ft².yr	5.9
	MJ/m².yr	227.9

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **SIZE:** **VINTAGE:** **REGION:**
Restaurant **Inland South**
Baseline

EUI SUMMARY

TOTAL ALL END-USES: **Electricity:** **60.9** kWh/ft².yr **2,357.5** MJ/m².yr **Fossil Fue** **47.9** kWh/ft².yr **1,857.0** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	0.9	36.1
ARCHITECTURAL LIGHTING	11.8	456.8
SPECIAL PURPOSE LIGHTING	0.0	0.0
OTHER PLUG LOADS	2.3	90.8
HVAC FANS & PUMPS	5.9	227.9
REFRIGERATION	16.8	650.0
COMPUTER EQUIPMENT	0.9	35.0
ELEVATORS	0.1	1.9
OUTDOOR LIGHTING	3.8	145.9

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	1.1	42.2	10.9	422.7
SPACE COOLING	2.0	77.1	0.0	0.0
DOMESTIC HOT WATER	6.8	263.7	13.3	514.3
FOOD SERVICE EQUIPMENT	8.5	330.0	23.2	900.0
MISCELLANEOUS	0.0	0.0	0.5	20.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Warehouse/Whsale	0		Inland South
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.65	W/m².°C	0.11	Btu/hr.ft².°F	Typical Building Size	3,200	m²	34,432	ft²
Roof U value (W/m².°C)	0.54	W/m².°C	0.09	Btu/hr.ft².°F	Typical Footprint (m²)	3,200	m²	34,432	ft²
Glazing U value (W/m².°C)	4.10	W/m².°C	0.72	Btu/hr.ft².°F	Footprint Aspect Ratio (L:W)	1			
					Percent Conditioned Space	100%			
					Percent Conditioned Space Defined as Exterior Zone	40%			
Window/Wall Ratio (WIWAR) (%)	0.05								
Shading Coefficient (SC)	0.80				Typical # Stories	1			
					Floor to Floor Height (m)	6.1	m	19.9	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	100%		0%		0%		0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	100	m²/person	1076	ft²/person	%OA	8.08%
Occupancy Schedule Occ. Period	90%					
Occupancy Schedule Unocc. Period	0%					
Fresh Air Requirements or Outside Air	35	L/s.person	74	CFM/person		

Fresh Air Control Type *(enter a 1, 2 or 3) | 1 | If Fresh Air Control Type = "2" enter % FA. to the right: | 0%
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air) | If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation | 0.5 L/s.m² | 0.10 CFM/ft²
50% operation (%)

Sizing Factor	1.6			
Total Air Circulation or Design Air Flow	4.33	L/s.m²	0.85	CFM/ft²
Infiltration Rate	0.70	L/s.m²	0.14	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	621,443	
Peak Zone Sensible Load	394,436	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	18,349	
Total air circulation or Design air	4.33	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	22	°C	71.6	°F	13	°C	55.4	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	16	°C	60.8	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	20.25	°C	68.45	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Warehouse/Whsale	0		Inland South
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	500	Lux	46.5	ft-candles
Floor Fraction (GLFF)	0.33			
Connected Load	14.6	W/m²	1.4	W/ft²
Occ. Period(Hrs./yr.)	3500			
Unocc. Period(Hrs./yr.)	5260			
Usage During Occupied Period	100%			
Usage During Unoccupied Period	25%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	300	500	700	1000	Total
% Distribution	0%	100%	0%	0%	100%
Weighted Average					**500**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			65.0%	0%	35.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	2.1
	MJ/m².yr	83

ARCHITECTURAL LIGHTING

Light Level	500	Lux	46.5	ft-candles
Floor Fraction (ALFF)	0.02			
Connected Load	55.3	W/m²	5.1	W/ft²
Occ. Period(Hrs./yr.)	2500			
Unocc. Period(Hrs./yr.)	6260			
Usage During Occupied Period	100%			
Usage During Unoccupied Period	50%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	300	500	700	1000	Total
% Distribution	0%	100%	0%	0%	100%
Weighted Average					**500**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	65%	35%					0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	0.6
	MJ/m².yr	22

SPECIAL PURPOSE LIGHTING

Light Level	420.00	Lux	39.0	ft-candles
Floor Fraction (HBLFF)	0.65			
Connected Load	16.3	W/m²	1.5	W/ft²
Occ. Period(Hrs./yr.)	3500			
Unocc. Period(Hrs./yr.)	5260			
Usage During Occupied Period	100%			
Usage During Unoccupied Period	25%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 — 1.00

Light Level (Lux)	300	500	700	1000	Total
% Distribution	40%	60%	0%	0%	100%
Weighted Average					**420**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)						80%	20%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.7	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	4.7
	MJ/m².yr	183

TOTAL LIGHTING

Overall LPD	16.47 W/m²	EUI TOTAL	kWh/ft².yr	7.5
	1.53 W/ft²		MJ/m².yr	289

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Servers	Plug Loads
Measured Power (W/device)	55	51	100	200	217	
Density (device/occupant)	0.5918	0.5918	0.03	0.03	0.06	
Connected Load	0.3 W/m²	0.3 W/m²	0.0 W/m²	0.1 W/m²	0.5 W/m²	2.5 W/m²
	0.0 W/ft²	0.0 W/ft²	0.00 W/ft²	0.01 W/ft²	0.05 W/ft²	0.23 W/ft²
Diversity Occupied Period	90%	90%	90%	90%	100%	90%
Diversity Unoccupied Period	50%	50%	50%	50%	100%	25%
Operation Occ. Period (hrs./year)	2000	2000	2600	2600	2600	4100
Operation Unocc. Period (hrs./year)	6760	6760	6160	6160	6160	4660

Total end-use load (occupied period)	3.4 W/m²	0.3 W/ft²
Total end-use load (unocc. period)	1.5 W/m²	0.1 W/ft²
Usage during occupied period	100%	
Usage during unoccupied period	44%	

Computer Equipment	EUI	kWh/ft².yr	0.76
		MJ/m².yr	29.58
Plug Loads	EUI	kWh/ft².yr	1.13
		MJ/m².yr	43.70

FOOD SERVICE EQUIPMENT

Provide description below:

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	0.1	EUI	kWh/ft².yr	0.1
	MJ/m².yr	5.0		MJ/m².yr	4.0

REFRIGERATION

Provide description below:

Walk-in coolers

EUI	kWh/ft².yr	0.6
	MJ/m².yr	25.0

MISCELLANEOUS

Provide description below:

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	0.5	EUI	kWh/ft².yr	0.0
	MJ/m².yr	20.0		MJ/m².yr	0.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Warehouse/Whsale	0		Inland South
Baseline			

SPACE HEATING

Heating Plant Type

							Electric			Other	
				Forced Air						Gas	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Radiant	
System Present (%)	4%	3%	1%	35%	5%	27%		2%	10%	13%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	75%	1.70	3.00	100%	75%	
Performance (1 / Eff. (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.33	0.59	0.33	1.00	1.33	

Peak Heating Load	27.9	W/m²	8.9	Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	237	MJ/m².yr	6.1	kWh/ft².yr
Sizing Factor	1.00			
Electric Fuel Share	12.0%	Fossil Fuel Share	88.0%	

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	5.4
MJ/m².yr	211

Gas EUI	
kWh/ft².yr	8.1
MJ/m².yr	314

Market Composite EUI	
kWh/ft².yr	7.8
MJ/m².yr	302

SPACE COOLING

A/C Plant Type

			WSHP			Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	0.0%	0.0%	0.0%	2.0%	98.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7	°C	44.6	°F
Condenser Water	30	°C	86	°F
Supply Air	13.0	°C	55.4	°F

Peak Cooling Load	57	W/m²	18	Btu/hr.ft²	665	ft²/Ton
Seasonal Cooling Load (Tertiary Load)	106.0	MJ/m².yr	2.7	kWh/ft².yr		

Sizing Factor: 1.00 — Operation (occ. period): 3000 hrs/year — Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C): 30.0%

Electric Fuel Share: 100.0% — Gas Fuel Share: 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenan

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	1.1
MJ/m².yr	43

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	1.1
MJ/m².yr	43

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	47%				3%
Eff./COP	0.65				0.75

	Fossil		Elec. Res.
Fuel Share	50%		50%
Blended Efficiency	0.66		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load): 25.0

Wetting Use Percentage: 90%

All Electric EUI	
kWh/ft².yr	0.7
MJ/m².yr	27

Fossil Fuel EUI	
kWh/ft².yr	1.0
MJ/m².yr	38

Market Composite EUI	
kWh/ft².yr	0.8
MJ/m².yr	32.8

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EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Warehouse/Whsale	0		Inland South
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	4.3	L/s.m²	0.85	CFM/ft²
System Static Pressure CAV	425	Pa	1.7	wg
System Static Pressure VAV	425	Pa	1.7	wg
Fan Efficiency	60%			
Fan Motor Efficiency	80%			
Sizing Factor	1.00			
Fan Design Load CAV	3.8	W/m²	0.36	W/ft²
Fan Design Load VAV	3.8	W/m²	0.36	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	100%	0%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	80%	20%	100%	0%
Comments:				

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m²	0.01	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.2	L/s.m²	0.03	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.2	W/m²	0.02	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.020	kW/kW	0.07	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	1.14	W/m²	0.11	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.003	L/s.m²	0.004	U.S. gpm/ft²
Pump Head Pressure	0	kPa	0	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.00	W/m²	0.00	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.002	L/s.m²	0.0036	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	50	kPa	17	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.2	W/m²	0.02	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	29.6	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	1.9	kWh/m².yr
Condenser Pump Energy Consumption	0.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.5	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	1.1	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI	kWh/ft².yr	3.1
	MJ/m².yr	119.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Warehouse/Whsale	0		Inland South
Baseline			

EUI SUMMARY

TOTAL ALL END-USES: **Electricity:** **15.0** kWh/ft².yr **582.8** MJ/m².yr **Fossil Fuel** **8.3** kWh/ft².yr **320.1** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	2.1	83.2
ARCHITECTURAL LIGHTING	0.6	22.4
SPECIAL PURPOSE LIGHTING	4.7	183.1
OTHER PLUG LOADS	1.1	43.7
HVAC FANS & PUMPS	3.1	119.0
REFRIGERATION	0.6	25.0
COMPUTER EQUIPMENT	0.8	29.6
ELEVATORS	0.1	3.9
OUTDOOR LIGHTING	0.4	17.0

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.7	25.3	7.1	276.1
SPACE COOLING	0.3	12.9	0.0	0.0
DOMESTIC HOT WATER	0.4	13.7	0.5	19.1
FOOD SERVICE EQUIPMENT	0.1	4.0	0.1	5.0
MISCELLANEOUS	0.0	0.0	0.5	20.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **Large High Rise** **Baseline**

SIZE: **> 9,300 m² (100,000 ft²)**

VINTAGE:

REGION: **Inland South**

CONSTRUCTION

Wall U value (W/m².°C)	0.81	W/m².°C	0.14	Btu/hr.ft² . °F
Roof U value (W/m².°C)	0.56	W/m².°C	0.10	Btu/hr.ft² . °F
Glazing U value (W/m².°C)	4.26	W/m².°C	0.75	Btu/hr.ft² . °F
Window/Wall Ratio (WIWAR) (%)	0.25			
Shading Coefficient (SC)	0.65			

Typical Building Size	21,365	m²	229,887	ft²
Typical Footprint (m²)	1,125	m²	12,100	ft²
Footprint Aspect Ratio (L:W)	2			
Percent Conditioned Space	100%			
Percent Conditioned Space Defined as Exterior Zone	45%			
Typical # Stories	19			
Floor to Floor Height (m)	3.7	m	12.0	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	100%		0%		0%		0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	40	m²/person	430	ft²/person
Occupancy Schedule Occ. Period	25%			
Occupancy Schedule Unocc. Period	80%			
Fresh Air Requirements or Outside Air	10	L/s.person	21	CFM/person

%OA 100.00%

Fresh Air Control Type *(enter a 1, 2 or 3) 3
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right:	0%			
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation	0.25	L/s.m²	0.05	CFM/ft²
	75%	operation (%)		

Sizing Factor	1			
Total Air Circulation or Design Air Flow	0.25	L/s.m²	0.05	CFM/ft²
Infiltration Rate	0.05	L/s.m²	0.01	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)		L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	3,977,323	
Peak Zone Sensible Load	2,895,645	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	134,705	
Total air circulation or Design air	2.98	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	20	°C	68	°F	13	°C	55.4	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	20.4	°C	68.72	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large High Rise	> 9,300 m² (100,000 ft²)		Inland South
Baseline			

LIGHTING

GENERAL (Linear Fluorescent) LIGHTING

Light Level	160	Lux	14.9	ft-candles
Floor Fraction (GLFF)	0.10			
Connected Load	4.6	W/m²	0.4	W/ft²
Occ. Period(Hrs./yr.)	3400			
Unocc. Period(Hrs./yr.)	5360			
Usage During Occupied Period	90%			
Usage During Unoccupied Period	90%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	50	100	200	300				Total
% Distribution	0%	60%	20%	20%				100%
Weighted Average								**160**
	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			60.0%	0%	40.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	0.3
	MJ/m².yr	13

ARCHITECTURAL (Incandescent & replacements) LIGHTING

Light Level	130	Lux	12.1	ft-candles
Floor Fraction (ALFF)	0.90			
Connected Load	13.7	W/m²	1.3	W/ft²
Occ. Period(Hrs./yr.)	2900			
Unocc. Period(Hrs./yr.)	5860			
Usage During Occupied Period	25%			
Usage During Unoccupied Period	20%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	50	200	300	500				Total
% Distribution	60%	20%	20%	0%				100%
Weighted Average								**130**
	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	60%	40%					0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	2.2
	MJ/m².yr	84

SPECIAL PURPOSE LIGHTING

Light Level	0.00	Lux	0.0	ft-candles
Floor Fraction (HBLFF)	0.00			
Connected Load	0.0	W/m²	0.0	W/ft²
Occ. Period(Hrs./yr.)	4000			
Unocc. Period(Hrs./yr.)	4760			
Usage During Occupied Period	0%			
Usage During Unoccupied Period	100%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 | 1.00

Light Level (Lux)	300	500	700	1000				Total
% Distribution		0%	0%	0%				0%
Weighted Average								**0**
	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)								0.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	0.0
	MJ/m².yr	0

TOTAL LIGHTING	Overall LPD	12.80 W/m²	EUI TOTAL	kWh/ft².yr	2.5
		1.19 W/ft²		MJ/m².yr	97

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Servers		Plug Loads	
Measured Power (W/device)	45		57		100		200		50			
Density (device/occupant)	0.6		0.6		0		0		0.00			
Connected Load	0.7	W/m²	0.9	W/m²	0.0	W/m²	0.0	W/m²	0.5	W/m²	1.3	W/m²
	0.1	W/ft²	0.1	W/ft²	0.00	W/ft²	0.00	W/ft²	0.05	W/ft²	0.12	W/ft²
Diversity Occupied Period	0%		0%		90%		90%		100%		40%	
Diversity Unoccupied Period	50%		50%		50%		10%		100%		85%	
Operation Occ. Period (hrs./year)	2900		2900		2600		2600		2600		3000	
Operation Unocc. Period (hrs./year)	5860		5860		6160		6160		6160		5760	

Total end-use load (occupied period)	1.0	W/m²	0.1	W/ft²
Total end-use load (unocc. period)	2.4	W/m²	0.2	W/ft²
Usage during occupied period	100%			
Usage during unoccupied period	231%			

	EUI		
Computer Equipment	EUI	kWh/ft².yr	0.84
		MJ/m².yr	32.38
Plug Loads	EUI	kWh/ft².yr	0.74
		MJ/m².yr	28.53

FOOD SERVICE EQUIPMENT

Provide description below:

Electric stoves (at 417 kWh/yr), etc.

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	0.3	EUI	kWh/ft².yr	0.7
	MJ/m².yr	10.0		MJ/m².yr	27.0

REFRIGERATION

Provide description below:

Residential refrigerators (560 kWh/yr) and freezers (370 kWh/yr)

EUI	kWh/ft².yr	0.8
	MJ/m².yr	30.0

MISCELLANEOUS

Provide description below:

Dryers, pools, fireplaces

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	1.0	EUI	kWh/ft².yr	0.0
	MJ/m².yr	40.0		MJ/m².yr	0.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Large High Rise	**> 9,300 m² (100,000 ft²)**		**Inland South**
Baseline			

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	35%	20%	5%	20%	5%	0%	3%	3%	9%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff. (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	24.5	W/m²	7.8	Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	314	MJ/m².yr	8.1	kWh/ft².yr
Sizing Factor	1.00			
Electric Fuel Share	15.0%	Fossil Fuel Share	85.0%	

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	kWh/ft².yr	6.4
	MJ/m².yr	247
Gas EUI	kWh/ft².yr	10.5
	MJ/m².yr	407
Market Composite EUI	kWh/ft².yr	9.9
	MJ/m².yr	383

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	1.0%	0.0%		5.0%	94.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7	°C	44.6	°F
Condenser Water	30	°C	86	°F
Supply Air	13.0	°C	55.4	°F

Peak Cooling Load	8	W/m²	3	Btu/hr.ft²	4624	ft²/Ton
Seasonal Cooling Load (Tertiary Load)	114.6	MJ/m².yr	3.0	kWh/ft².yr		

Sizing Factor: 0.15 — Operation (occ. period): 3000 hrs/year — Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C): 11.0%

Electric Fuel Share: 100.0% — Gas Fuel Share: 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenan

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	kWh/ft².yr	0.7
	MJ/m².yr	29
Natural Gas EUI	kWh/ft².yr	0.0
	MJ/m².yr	0
Market Composite EUI	kWh/ft².yr	0.7
	MJ/m².yr	29

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	25%				50%
Eff./COP	0.65				0.75

	Fossil	Elec. Res.
Fuel Share	75%	25%
Blended Efficiency	0.72	1.00

Service Hot Water load (MJ/m².yr) (Tertiary Load): 200.0

Wetting Use Percentage: 80%

All Electric EUI		Fossil Fuel EUI		Market Composite EUI	
kWh/ft².yr	5.2	kWh/ft².yr	7.2	kWh/ft².yr	6.7
MJ/m².yr	200	MJ/m².yr	279	MJ/m².yr	259.3

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Large High Rise	**> 9,300 m² (100,000 ft²)**		**Inland South**
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	0.3	L/s.m²	0.05	CFM/ft²
System Static Pressure CAV	625	Pa	2.5	wg
System Static Pressure VAV	0	Pa	0.0	wg
Fan Efficiency	52%			
Fan Motor Efficiency	90%			
Sizing Factor	1.00			
Fan Design Load CAV	0.3	W/m²	0.03	W/ft²
Fan Design Load VAV	0.0	W/m²	0.00	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	100%	0%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	75%	25%	75%	25%
Comments:				

EXHAUST FANS

Washroom Exhaust	50	L/s.washroom	106	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m²	0.02	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.2	L/s.m²	0.04	CFM/ft²
Exhaust System Static Pressure	125	Pa	0.5	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.1	W/m²	0.01	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.000	kW/kW	0.00	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	0.00	W/m²	0.00	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.000	L/s.m²	0.001	U.S. gpm/ft²
Pump Head Pressure	0	kPa	0	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.00	W/m²	0.00	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.000	L/s.m²	0.0005	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.1	W/m²	0.01	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	2.5	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	0.9	kWh/m².yr
Condenser Pump Energy Consumption	0.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.0	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	0.4	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI	kWh/ft².yr	0.4
	MJ/m².yr	13.6

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: Large High Rise
Baseline

SIZE: > 9,300 m² (100,000 ft²)

VINTAGE:

REGION: Inland South

EUI SUMMARY

TOTAL ALL END-USES:	Electricity:	9.1	kWh/ft².yr	351.5	MJ/m².yr	Fossil Fue	15.6	kWh/ft².yr	605.7	MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL (Linear Fluorescent) LIGHT	0.3	13.1
ARCHITECTURAL (Incandescent & re	2.2	84.3
SPECIAL PURPOSE LIGHTING	0.0	0.0
OTHER PLUG LOADS	0.7	28.5
HVAC FANS & PUMPS	0.4	13.6
REFRIGERATION	0.8	30.0
COMPUTER EQUIPMENT	0.8	32.4
ELEVATORS	0.4	15.5
OUTDOOR LIGHTING	0.4	17.0

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	1.0	37.0	8.9	346.4
SPACE COOLING	0.1	3.2	0.0	0.0
DOMESTIC HOT WATER	1.3	50.0	5.4	209.3
FOOD SERVICE EQUIPMENT	0.7	27.0	0.3	10.0
MISCELLANEOUS	0.0	0.0	1.0	40.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Medium Apartment			**Inland South**
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.81	W/m².°C	0.14	Btu/hr.ft² . °F
Roof U value (W/m².°C)	0.56	W/m².°C	0.10	Btu/hr.ft² . °F
Glazing U value (W/m².°C)	4.26	W/m².°C	0.75	Btu/hr.ft² . °F
Window/Wall Ratio (WIWAR) (%)	0.25			
Shading Coefficient (SC)	0.65			

Typical Building Size	8,000	m²	86,080	ft²
Typical Footprint (m²)	1,600	m²	17,216	ft²
Footprint Aspect Ratio (L:W)	3			
Percent Conditioned Space	100%			
Percent Conditioned Space Defined as Exterior Zone	45%			
Typical # Stories	5			
Floor to Floor Height (m)	3.7	m	12.0	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	100%		0%		0%		0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	40	m²/person	430	ft²/person
Occupancy Schedule Occ. Period	25%			
Occupancy Schedule Unocc. Period	80%			
Fresh Air Requirements or Outside Air	10	L/s.person	21	CFM/person

%OA 100.00%

Fresh Air Control Type *(enter a 1, 2 or 3) 3
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right:	0%			
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation	0.25	L/s.m²	0.05	CFM/ft²
	75%	operation (%)		

Sizing Factor	1			
Total Air Circulation or Design Air Flow	0.25	L/s.m²	0.05	CFM/ft²
Infiltration Rate	0.05	L/s.m²	0.01	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)		L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	1,449,870	
Peak Zone Sensible Load	1,044,852	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	48,606	
Total air circulation or Design air	2.87	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	20	°C	68	°F	13	°C	55.4	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	20.4	°C	68.72	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Apartment			Inland South
Baseline			

LIGHTING

GENERAL (Linear Fluorescent) LIGHTING

Light Level	160	Lux	14.9	ft-candles
Floor Fraction (GLFF)	0.10			
Connected Load	4.6	W/m²	0.4	W/ft²

Occ. Period(Hrs./yr.)	3400
Unocc. Period(Hrs./yr.)	5360
Usage During Occupied Period	90%
Usage During Unoccupied Period	90%

Light Level (Lux)	50	100	200	300				Total
% Distribution	0%	60%	20%	20%				100%
Weighted Average								**160**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			60.0%	0%	40.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

Fixture Cleaning:
- Incidence of Practice
- Interval — years

Relamping Strategy & Incidence of Practice: Group | Spot

EUI	kWh/ft².yr	0.3
	MJ/m².yr	13

ARCHITECTURAL (Incandescent & replacements) LIGHTING

Light Level	130	Lux	12.1	ft-candles
Floor Fraction (ALFF)	0.90			
Connected Load	13.7	W/m²	1.3	W/ft²

Occ. Period(Hrs./yr.)	2900
Unocc. Period(Hrs./yr.)	5860
Usage During Occupied Period	25%
Usage During Unoccupied Period	20%

Light Level (Lux)	50	200	300	500				Total
% Distribution	60%	20%	20%	0%				100%
Weighted Average								**130**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	60%	40%					0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

Fixture Cleaning:
Incidence of Practice
Interval — years

Relamping Strategy & Incidence of Practice: Group | Spot

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	2.2
	MJ/m².yr	84

SPECIAL PURPOSE LIGHTING

Light Level	0.00	Lux	0.0	ft-candles
Floor Fraction (HBLFF)	0.00			
Connected Load	0.0	W/m²	0.0	W/ft²

Floor fraction check: should = 1.00 — 1.00

Occ. Period(Hrs./yr.)	4000
Unocc. Period(Hrs./yr.)	4760
Usage During Occupied Period	0%
Usage During Unoccupied Period	100%

Light Level (Lux)	300	500	700	1000				Total
% Distribution		0%	0%	0%				0%
Weighted Average								**0**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)								0.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

Fixture Cleaning:
Incidence of Practice
Interval — years

Relamping Strategy & Incidence of Practice: Group | Spot

EUI	kWh/ft².yr	0.0
	MJ/m².yr	0

TOTAL LIGHTING

Overall LPD	12.80 W/m²	EUI TOTAL	kWh/ft².yr	2.5
	1.19 W/ft²		MJ/m².yr	97

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Servers		Plug Loads	
Measured Power (W/device)	45		57		100		200		50			
Density (device/occupant)	0.6		0.6		0		0		0.00			
Connected Load	0.7	W/m²	0.9	W/m²	0.0	W/m²	0.0	W/m²	0.5	W/m²	1.3	W/m²
	0.1	W/ft²	0.1	W/ft²	0.00	W/ft²	0.00	W/ft²	0.05	W/ft²	0.12	W/ft²
Diversity Occupied Period	0%		0%		90%		90%		100%		40%	
Diversity Unoccupied Period	50%		50%		50%		10%		100%		85%	
Operation Occ. Period (hrs./year)	2900		2900		2600		2600		2600		3000	
Operation Unocc. Period (hrs./year)	5860		5860		6160		6160		6160		5760	

Total end-use load (occupied period)	1.0	W/m²	0.1	W/ft²
Total end-use load (unocc. period)	2.4	W/m²	0.2	W/ft²

Usage during occupied period	100%
Usage during unoccupied period	231%

Computer Equipment	EUI	kWh/ft².yr	0.84
		MJ/m².yr	32.38
Plug Loads	EUI	kWh/ft².yr	0.74
		MJ/m².yr	28.53

FOOD SERVICE EQUIPMENT

Provide description below:
Electric stoves (at 417 kWh/yr), etc.

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	0.1	EUI	kWh/ft².yr	0.7
	MJ/m².yr	5.0		MJ/m².yr	27.0

REFRIGERATION

Provide description below:
Residential refrigerators (560 kWh/yr) and freezers (370 kWh/yr)

EUI	kWh/ft².yr	0.8
	MJ/m².yr	30.0

MISCELLANEOUS

Provide description below:
pools, dryers, fireplaces, bbq etc

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	0.8	EUI	kWh/ft².yr	0.0
	MJ/m².yr	30.0		MJ/m².yr	0.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **Medium Apartment** **Baseline** | **SIZE:** | **VINTAGE:** | **REGION:** **Inland South**

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	30%	10%	5%	20%	15%	0%	3%	3%	14%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff.) (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	24.9	W/m²	7.9	Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	321	MJ/m².yr	8.3	kWh/ft².yr
Sizing Factor	1.00			
Electric Fuel Share	20.0%	Fossil Fuel Share	80.0%	

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	7.0
MJ/m².yr	269

Gas EUI	
kWh/ft².yr	10.7
MJ/m².yr	415

Market Composite EUI	
kWh/ft².yr	10.0
MJ/m².yr	386

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	0.0%	0.0%		0.0%	100.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7	°C	44.6	°F
Condenser Water	30	°C	86	°F
Supply Air	13.0	°C	55.4	°F

Peak Cooling Load	8	W/m²	3	Btu/hr.ft²	4750	ft²/Ton
Seasonal Cooling Load (Tertiary Load)	110.3	MJ/m².yr	2.8	kWh/ft².yr		

Sizing Factor: 0.15 — Operation (occ. period): 3000 hrs/year — Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C): 11.0%

Electric Fuel Share: 100.0% — Gas Fuel Share: 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	0.7
MJ/m².yr	28

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	0.7
MJ/m².yr	28

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	50%				20%
Eff./COP	0.65				0.75

	Fossil		Elec. Res.
Fuel Share	70%		30%
Blended Efficiency	0.68		1.00

Service Hot Water load (MJ/m².yr) (Tertiary Load): 180.0

Wetting Use Percentage: 80%

All Electric EUI	
kWh/ft².yr	4.6
MJ/m².yr	180

Fossil Fuel EUI	
kWh/ft².yr	6.8
MJ/m².yr	265

Market Composite EUI	
kWh/ft².yr	6.2
MJ/m².yr	239.7

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Apartment			Inland South
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	0.3	L/s.m²	0.05	CFM/ft²
System Static Pressure CAV	625	Pa	2.5	wg
System Static Pressure VAV	0	Pa	0.0	wg
Fan Efficiency	52%			
Fan Motor Efficiency	90%			
Sizing Factor	1.00			
Fan Design Load CAV	0.3	W/m²	0.03	W/ft²
Fan Design Load VAV	0.0	W/m²	0.00	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	100%	0%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	75%	25%	75%	25%
Comments:				

EXHAUST FANS

Washroom Exhaust	50	L/s.washroom	106	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m²	0.01	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.2	L/s.m²	0.03	CFM/ft²
Exhaust System Static Pressure	125	Pa	0.5	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.1	W/m²	0.01	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.000	kW/kW	0.00	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	0.00	W/m²	0.00	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.000	L/s.m²	0.001	U.S. gpm/ft²
Pump Head Pressure	0	kPa	0	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.00	W/m²	0.00	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.000	L/s.m²	0.0005	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.1	W/m²	0.01	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	2.5	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	0.8	kWh/m².yr
Condenser Pump Energy Consumption	0.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.0	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	0.3	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI		
	kWh/ft².yr	0.3
	MJ/m².yr	13.1

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Apartment			Inland South
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**9.5** kWh/ft².yr	**367.9** MJ/m².yr	
	Fossil Fue	**14.3** kWh/ft².yr	**553.1** MJ/m².yr	

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL (Linear Fluorescent) LIGHT	0.3	13.1
ARCHITECTURAL (Incandescent & re	2.2	84.3
SPECIAL PURPOSE LIGHTING	0.0	0.0
OTHER PLUG LOADS	0.7	28.5
HVAC FANS & PUMPS	0.3	13.1
REFRIGERATION	0.8	30.0
COMPUTER EQUIPMENT	0.8	32.4
ELEVATORS	0.3	11.6
OUTDOOR LIGHTING	0.4	17.0

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	1.4	53.9	8.6	332.4
SPACE COOLING	0.1	3.1	0.0	0.0
DOMESTIC HOT WATER	1.4	54.0	4.8	185.7
FOOD SERVICE EQUIPMENT	0.7	27.0	0.1	5.0
MISCELLANEOUS	0.0	0.0	0.8	30.0

Appendix B Background – Section 4: Reference Case Natural Gas Forecast

Introduction

Appendix B provides additional detailed information related to the construction of the Commercial sector Reference Case. The appendix discusses the following:

- Additional Reference Case Results – Vancouver Island, Inland South & Inland North Regions.
- CEEAM Archetype Summaries – New Buildings.

B1 Additional Reference Case Results

Exhibit 55 Reference Case Forecast, by Milestone Year and Sub Sector for Vancouver Island (GJ/yr.)

Sub Sector	2010	2015	2020	2025	2030
Large Office	279,238	300,183	315,575	322,203	327,192
Medium Office	119,614	129,727	137,190	140,470	142,967
Large Non-food Retail	29,878	31,268	32,289	32,692	32,980
Medium Non-food Retail	46,749	50,152	52,697	53,813	54,661
Food Retail	152,433	164,517	173,564	177,628	180,774
Large Hotel	126,860	137,045	144,673	148,023	150,591
Medium Hotel	45,975	49,445	52,037	53,162	54,018
Hospital	524,806	554,720	576,254	585,080	591,560
Nursing Home	158,863	172,144	182,071	186,491	189,897
Large School	228,662	247,522	261,419	267,475	272,065
Medium School	247,537	260,803	270,399	274,206	276,930
University/College	375,024	401,893	421,719	430,362	436,927
Restaurant	395,550	430,218	456,373	468,656	478,441
Warehouse/Wholesale	37,090	39,903	41,982	42,889	43,576
Large Apartment	361,040	387,781	407,339	415,399	421,296
Medium Apartment	255,476	277,425	293,556	300,387	305,466
Small Commercial	1,759,824	1,918,832	2,042,568	2,107,138	2,161,343
Recreation Facilities and Other	1,124,436	1,226,034	1,305,095	1,346,352	1,380,986
Grand Total	6,269,053	6,779,613	7,166,802	7,352,425	7,501,672

Exhibit 56 Reference Case Forecast, by Milestone Year and Sub Sector for Inland South (GJ/yr.)

Sub Sector	2010	2015	2020	2025	2030
Large Office	165,585	174,556	181,557	186,745	190,992
Medium Office	125,275	132,643	138,412	142,708	146,240
Large Non-food Retail	163,200	173,930	182,440	188,860	194,195
Medium Non-food Retail	114,369	120,215	124,823	128,264	131,101
Food Retail	50,579	54,759	58,093	60,637	62,773
Large Hotel	157,618	166,654	173,788	179,132	183,558
Medium Hotel	110,988	117,049	121,823	125,387	128,331
Hospital	442,940	464,595	481,315	493,581	503,543
Nursing Home	238,597	254,948	267,904	277,691	285,844
Large School	169,888	181,384	190,413	197,171	202,750
Medium School	166,829	177,977	186,717	193,243	198,617
University/College	83,713	91,447	97,581	102,241	106,136
Restaurant	424,022	454,564	478,981	497,712	513,541
Warehouse/Wholesale	429,976	453,052	472,180	487,529	501,078
Large Apartment	10,579	11,458	12,154	12,681	13,120
Medium Apartment	222,060	233,146	241,761	247,972	253,168
Small Commercial	176,664	186,178	193,590	198,958	203,461
Recreation Facilities and Other	2,414,086	2,543,650	2,651,039	2,737,217	2,813,285
Grand Total	5,666,967	5,992,207	6,254,569	6,457,729	6,631,734

Exhibit 57 Reference Case Forecast, by Milestone Year and Sub Sector for Inland North (GJ/yr.)

Sub Sector	2010	2015	2020	2025	2030
Large Office	83,889	86,908	89,223	90,890	92,222
Medium Office	99,498	103,514	106,612	108,867	110,684
Large Non-food Retail	90,709	95,850	99,910	102,952	105,466
Medium Non-food Retail	69,362	72,462	74,893	76,695	78,170
Food Retail	41,874	43,603	44,953	45,948	46,761
Large Hotel	59,021	61,737	63,865	65,440	66,731
Medium Hotel	72,652	75,890	78,422	80,290	81,817
Hospital	367,048	376,750	383,992	389,013	392,885
Nursing Home	98,223	102,057	105,035	107,215	108,983
Large School	124,773	128,311	130,985	132,863	134,329
Medium School	122,526	127,682	131,658	134,549	136,876
University/College	209,084	219,056	226,819	232,548	237,222
Restaurant	376,700	393,794	407,270	417,388	425,791
Warehouse/Wholesale	28,317	29,528	30,467	31,155	31,713
Large Apartment	130,815	136,394	140,701	143,772	146,320
Medium Apartment	103,351	108,128	111,828	114,481	116,691
Small Commercial	2,260,496	2,381,389	2,481,573	2,561,951	2,632,903
Recreation Facilities and Other	325,791	343,214	357,653	369,238	379,464
Grand Total	4,664,130	4,886,268	5,065,860	5,205,255	5,325,027

Exhibit 58 Comparison of Whole Building Gas EUIs by Sub Sector and Area in the Reference Case (MJ/m²/yr.)

	Vancouver Island		Northern Interior		Southern Interior	
Sub Sector	Existing Buildings	New Buildings	Existing Buildings	New Buildings	Existing Buildings	New Buildings
Large Office	362	342	596	513	420	387
Medium Office	403	423	634	600	457	475
Large Non-food Retail	349	182	470	502	412	231
Medium Non-food Retail	378	290	496	428	441	250
Food Retail	508	456	919	804	497	521
Large Hotel	735	652	976	917	805	680
Medium Hotel	643	540	815	747	683	569
Hospital	1430	1298	2954	2446	1778	1573
Nursing Home	678	646	1182	995	723	695
Large School	343	353	811	577	387	565
Medium School	432	304	729	719	487	334
University/College	556	498	1113	1209	615	550
Restaurant	1793	1902	2793	2847	1857	1989
Warehouse/Wholesale	273	248	577	546	320	288
Large Apartment	550	499	694	674	606	549
Medium Apartment	499	517	632	657	553	536

B2 CEEAM Archetype Summaries – New Buildings

This section includes summary profiles of the 64 existing building archetypes constructed for this study. Exhibit 59 presents a table of contents for the CEEAM building profiles that follow.

Exhibit 59 Table of Contents - New CEEAM Building Profiles

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Office	> 9,300 m² (100,000 ft²)		Lower Mainland
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.88	W/m².°C	0.15	Btu/hr.ft² . °F
Roof U value (W/m².°C)	0.34	W/m².°C	0.06	Btu/hr.ft² . °F
Glazing U value (W/m².°C)	3.50	W/m².°C	0.62	Btu/hr.ft² . °F
Window/Wall Ratio (WIWAR) (%)	0.60			
Shading Coefficient (SC)	0.40			

Typical Building Size	21,365	m²	229,887	ft²
Typical Footprint (m²)	1,526	m²	16,421	ft²
Footprint Aspect Ratio (L:W)	1			
Percent Conditioned Space	100%			
Percent Conditioned Space Defined as Exterior Zone	45%			
Typical # Stories	14			
Floor to Floor Height (m)	3.7	m	12.0	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	50%		0%		50%		0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	26	m²/person	274	ft²/person
Occupancy Schedule Occ. Period	90%			
Occupancy Schedule Unocc. Period	0%			
Fresh Air Requirements or Outside Air	20	L/s.person	42	CFM/person

%OA 16.74%

Fresh Air Control Type *(enter a 1, 2 or 3) 1
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right: 34%
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation 0.5 L/s.m² 0.10 CFM/ft²
50% operation (%)

Sizing Factor	1.7			
Total Air Circulation or Design Air Flow	4.68	L/s.m²	0.92	CFM/ft²
Infiltration Rate	0.19	L/s.m²	0.04	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	6,160,533	
Peak Zone Sensible Load	2,681,773	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	124,756	
Total air circulation or Design air	4.68	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	24	°C	75.2	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	20.4	°C	68.72	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

B
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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Office	> 9,300 m² (100,000 ft²)		Lower Mainland
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	440	Lux	40.9	ft-candles
Floor Fraction (GLFF)	0.95			
Connected Load	11.4	W/m²	1.1	W/ft²
Occ. Period(Hrs./yr.)	2900			
Unocc. Period(Hrs./yr.)	5860			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	25%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	300	500	700	1000				Total
% Distribution	30%	70%	0%	0%				100%
Weighted Average								**440**
	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)					100.0%			100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	4.2
	MJ/m².yr	164

ARCHITECTURAL LIGHTING

Light Level	300	Lux	27.9	ft-candles
Floor Fraction (ALFF)	0.05			
Connected Load	20.9	W/m²	1.9	W/ft²
Occ. Period(Hrs./yr.)	3400			
Unocc. Period(Hrs./yr.)	5360			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	50%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	300	500	700	1000				Total
% Distribution	100%	0%	0%	0%				100%
Weighted Average								**300**
	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	25%	75%					0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	0.6
	MJ/m².yr	22

SPECIAL PURPOSE LIGHTING

Light Level	0.00	Lux	0.0	ft-candles
Floor Fraction (HBLFF)	0.00			
Connected Load	0.0	W/m²	0.0	W/ft²
Occ. Period(Hrs./yr.)	4000			
Unocc. Period(Hrs./yr.)	4760			
Usage During Occupied Period	0%			
Usage During Unoccupied Period	100%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 | 1.00

Light Level (Lux)	300	500	700	1000				Total
% Distribution		0%	0%	0%				0%
Weighted Average								**0**
	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)								0.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	0.0
	MJ/m².yr	0

TOTAL LIGHTING

Overall LPD	11.84 W/m²	EUI TOTAL	kWh/ft².yr	4.8
	1.10 W/ft²		MJ/m².yr	186

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Servers		Plug Loads	
Measured Power (W/device)	55		51		100		200		217			
Density (device/occupant)	0.9		0.9		0.15		0.1		0.06			
Connected Load	1.9	W/m²	1.8	W/m²	0.6	W/m²	0.8	W/m²	0.5	W/m²	2.5	W/m²
	0.2	W/ft²	0.2	W/ft²	0.05	W/ft²	0.07	W/ft²	0.05	W/ft²	0.23	W/ft²
Diversity Occupied Period	90%		90%		90%		90%		100%		90%	
Diversity Unoccupied Period	50%		50%		50%		50%		100%		25%	
Operation Occ. Period (hrs./year)	2500		2500		2500		2500		2500		3000	
Operation Unocc. Period (hrs./year)	6260		6260		6260		6260		6260		5760	

Total end-use load (occupied period)	7.3	W/m²	0.7	W/ft²
Total end-use load (unocc. period)	3.7	W/m²	0.3	W/ft²
Usage during occupied period	100%			
Usage during unoccupied period	50%			

Computer Equipment	EUI	kWh/ft².yr	2.96
		MJ/m².yr	114.76
Plug Loads	EUI	kWh/ft².yr	0.96
		MJ/m².yr	37.26

FOOD SERVICE EQUIPMENT

Provide description below:

	Gas EUI			Electric EUI		
Cafeteria	EUI	kWh/ft².yr	0.3	EUI	kWh/ft².yr	0.1
		MJ/m².yr	10.0		MJ/m².yr	3.0

REFRIGERATION

Provide description below:

Unknown	EUI	kWh/ft².yr	0.1
		MJ/m².yr	4.0

MISCELLANEOUS

Provide description below:

	Gas EUI			Electric EUI		
	EUI	kWh/ft².yr	0.3	EUI	kWh/ft².yr	0.0
		MJ/m².yr	10.0		MJ/m².yr	0.0

B
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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Large Office	**> 9,300 m² (100,000 ft²)**		**Lower Mainland**
Baseline			

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	35%	35%	15%	10%	0%	0%	1%	1%	3%	0%	100%
Seasonal Eff./COP	75%	80%	90%	77%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff. (kW/kW)	1.33	1.25	1.11	1.30	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load 29.2 W/m² 9.3 Btu/hr.ft²
Seasonal Heating Load (Tertiary Load) 228 MJ/m².yr 5.9 kWh/ft².yr
Sizing Factor 1.00

Electric Fuel Share 5.0% Fossil Fuel Share 95.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	4.6
MJ/m².yr	179

Gas EUI	
kWh/ft².yr	7.4
MJ/m².yr	288

Market Composite EUI	
kWh/ft².yr	7.3
MJ/m².yr	282

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	0.0%	70.0%	20.0%	5.0%	5.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7	°C	44.6	°F
Condenser Water	30	°C	86	°F
Supply Air	14.0	°C	57.2	°F

Peak Cooling Load 84 W/m² 27 Btu/hr.ft² 448 ft²/Ton
Seasonal Cooling Load (Tertiary Load) 142.9 MJ/m².yr 3.7 kWh/ft².yr

Sizing Factor 1.00 Operation (occ. period) 3000 hrs/year Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C) 90.0%

Electric Fuel Share 100.0% Gas Fuel Share 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

All Electric EUI	
kWh/ft².yr	1.5
MJ/m².yr	56

Cooling Tower/Air Cooled Condenser Maintenan

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	1.5
MJ/m².yr	56

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	40%				30%
Eff./COP	0.65				0.80

	Fossil	Elec. Res.
Fuel Share	70%	30%
Blended Efficiency	0.71	0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 35.0

Wetting Use Percentage 90%

All Electric EUI	
kWh/ft².yr	1.0
MJ/m².yr	38

Fossil Fuel EUI	
kWh/ft².yr	1.3
MJ/m².yr	49

Market Composite EUI	
kWh/ft².yr	1.2
MJ/m².yr	45.8

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Office	> 9,300 m² (100,000 ft²)		Lower Mainland
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	4.7	L/s.m²	0.92	CFM/ft²
System Static Pressure CAV	900	Pa	3.6	wg
System Static Pressure VAV	900	Pa	3.6	wg
Fan Efficiency	52%			
Fan Motor Efficiency	85%			
Sizing Factor	1.00			
Fan Design Load CAV	9.5	W/m²	0.89	W/ft²
Fan Design Load VAV	9.5	W/m²	0.89	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	50%	50%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	50%	50%	100%	0%

Comments:

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m²	0.03	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.2	L/s.m²	0.05	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	80%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.3	W/m²	0.03	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.020	kW/kW	0.07	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	1.69	W/m²	0.16	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.004	L/s.m²	0.007	U.S. gpm/ft²
Pump Head Pressure	90	kPa	30	ft
Pump Efficiency	55%			
Pump Motor Efficiency	85%			
Sizing Factor	1.0			
Pump Connected Load	0.86	W/m²	0.08	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.004	L/s.m²	0.0054	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	150	kPa	50	ft		
Pump Efficiency	55%					
Pump Motor Efficiency	85%					
Sizing Factor	0.8					
Pump Connected Load	0.9	W/m²	0.09	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	48.2	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	2.5	kWh/m².yr
Condenser Pump Energy Consumption	1.7	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.7	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	4.7	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI		
	kWh/ft².yr	5.4
	MJ/m².yr	208.4

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Large Office	**> 9,300 m² (100,000 ft²)**		**Lower Mainland**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**16.9**	kWh/ft².yr	**653.3**	MJ/m².yr	**Fossil Fue**	**8.5** kWh/ft².yr	**327.6** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	4.2	164.0
ARCHITECTURAL LIGHTING	0.6	22.2
SPECIAL PURPOSE LIGHTING	0.0	0.0
OTHER PLUG LOADS	1.0	37.3
HVAC FANS & PUMPS	5.4	208.4
REFRIGERATION	0.1	4.0
COMPUTER EQUIPMENT	3.0	114.8
ELEVATORS	0.3	11.6
OUTDOOR LIGHTING	0.4	17.0

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.2	8.9	7.1	273.3
SPACE COOLING	1.3	50.6	0.0	0.0
DOMESTIC HOT WATER	0.3	11.5	0.9	34.3
FOOD SERVICE EQUIPMENT	0.1	3.0	0.3	10.0
MISCELLANEOUS	0.0	0.0	0.3	10.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **Medium Office** **Baseline**
SIZE: **50,000 to 100,000 ft²**
VINTAGE:
REGION: **Lower Mainland**

CONSTRUCTION

Wall U value (W/m².°C)	0.89	W/m².°C	0.16	Btu/hr.ft² . °F
Roof U value (W/m².°C)	0.34	W/m².°C	0.06	Btu/hr.ft² . °F
Glazing U value (W/m².°C)	3.50	W/m².°C	0.62	Btu/hr.ft² . °F
Window/Wall Ratio (WIWAR) (%)	0.45			
Shading Coefficient (SC)	0.45			

Typical Building Size	6,777	m²	72,921	ft²
Typical Footprint (m²)	753	m²	8,102	ft²
Footprint Aspect Ratio (L:W)	1			
Percent Conditioned Space	100%			
Percent Conditioned Space Defined as Exterior Zone	45%			
Typical # Stories	9			
Floor to Floor Height (m)	3.7	m	12.0	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	50%		0%		50%		0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	26	m²/person	274	ft²/person
Occupancy Schedule Occ. Period	90%			
Occupancy Schedule Unocc. Period	0%			
Fresh Air Requirements or Outside Air	20	L/s.person	42	CFM/person

%OA 16.78%

Fresh Air Control Type *(enter a 1, 2 or 3) 1
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right: 34%
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation 0.5 L/s.m² 0.10 CFM/ft²
50% operation (%)

Sizing Factor	1.6			
Total Air Circulation or Design Air Flow	4.67	L/s.m²	0.92	CFM/ft²
Infiltration Rate	0.19	L/s.m²	0.04	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	2,005,200	
Peak Zone Sensible Load	901,734	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	41,949	
Total air circulation or Design air	4.67	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	22	°C	71.6	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	20.4	°C	68.72	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Office	50,000 to 100,000 ft^2		Lower Mainland
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	460	Lux	42.8	ft-candles
Floor Fraction (GLFF)	0.98			
Connected Load	11.9	W/m^2	1.1	W/ft^2

Occ. Period(Hrs./yr.)	2900
Unocc. Period(Hrs./yr.)	5860
Usage During Occupied Period	95%
Usage During Unoccupied Period	25%

Light Level (Lux)	300	500	700	1000	Total
% Distribution	20%	80%	0%	0%	100%
Weighted Average					**460**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			0.0%		100.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

Fixture Cleaning:
Incidence of Practice
Interval years

Relamping Strategy & Incidence of Practice	Group	Spot

EUI	kWh/ft^2.yr	4.6
	MJ/m^2.yr	177

ARCHITECTURAL LIGHTING

Light Level	300	Lux	27.9	ft-candles
Floor Fraction (ALFF)	0.02			
Connected Load	20.9	W/m^2	1.9	W/ft^2

Occ. Period(Hrs./yr.)	3400
Unocc. Period(Hrs./yr.)	5360
Usage During Occupied Period	100%
Usage During Unoccupied Period	90%

Light Level (Lux)	300	500	700	1000	Total
% Distribution	100%	0%	0%	0%	100%
Weighted Average					**300**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	25%	75%					0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

Fixture Cleaning:
Incidence of Practice
Interval years

Relamping Strategy & Incidence of Practice	Group	Spot

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft^2.yr	0.3
	MJ/m^2.yr	12

SPECIAL PURPOSE LIGHTING

Light Level	0.00	Lux	0.0	ft-candles
Floor Fraction (HBLFF)	0.00			
Connected Load	0.0	W/m^2	0.0	W/ft^2

Floor fraction check: should = 1.00	1.00

Occ. Period(Hrs./yr.)	3400
Unocc. Period(Hrs./yr.)	5360
Usage During Occupied Period	95%
Usage During Unoccupied Period	40%

Light Level (Lux)	300	500	700	1000	Total
% Distribution		0%	0%	0%	0%
Weighted Average					**0**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)								0.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

Fixture Cleaning:
Incidence of Practice
Interval years

Relamping Strategy & Incidence of Practice	Group	Spot

EUI	kWh/ft^2.yr	0.0
	MJ/m^2.yr	0

TOTAL LIGHTING

Overall LPD	12.06 W/m^2	EUI TOTAL	kWh/ft^2.yr	4.9
	1.12 W/ft^2		MJ/m^2.yr	189

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Servers	Plug Loads
Measured Power (W/device)	55	51	100	200	217	
Density (device/occupant)	0.9	0.9	0.15	0.1	0.06	
Connected Load	1.9 W/m^2	1.8 W/m^2	0.6 W/m^2	0.8 W/m^2	0.5 W/m^2	1 W/m^2
	0.2 W/ft^2	0.2 W/ft^2	0.05 W/ft^2	0.07 W/ft^2	0.05 W/ft^2	0.09 W/ft^2
Diversity Occupied Period	90%	90%	90%	90%	100%	80%
Diversity Unoccupied Period	50%	50%	50%	50%	100%	25%
Operation Occ. Period (hrs./year)	2500	2500	2500	2500	2500	2500
Operation Unocc. Period (hrs./year)	6260	6260	6260	6260	6260	6260

Total end-use load (occupied period)	5.9 W/m^2	0.5 W/ft^2
Total end-use load (unocc. period)	3.3 W/m^2	0.3 W/ft^2

Usage during occupied period	100%
Usage during unoccupied period	56%

Computer Equipment	EUI	kWh/ft^2.yr	2.96
		MJ/m^2.yr	114.76
Plug Loads	EUI	kWh/ft^2.yr	0.33
		MJ/m^2.yr	12.83

FOOD SERVICE EQUIPMENT

Provide description below:
Lunch room/cafeteria/restaurant

Gas EUI			Electric EUI		
EUI	kWh/ft^2.yr	0.3	EUI	kWh/ft^2.yr	0.1
	MJ/m^2.yr	10.0		MJ/m^2.yr	3.0

REFRIGERATION

Provide description below:
Lunch room/cafeteria/restaurant

EUI	kWh/ft^2.yr	0.1
	MJ/m^2.yr	4.0

MISCELLANEOUS

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft^2.yr	0.5	EUI	kWh/ft^2.yr	0.0
	MJ/m^2.yr	20.0		MJ/m^2.yr	

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Office	50,000 to 100,000 ft²		Lower Mainland
Baseline			

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	5%	35%	10%	45%	0%	0%	2%	1%	2%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff. (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	35.3	W/m²	11.2	Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	282	MJ/m².yr	7.3	kWh/ft².yr
Sizing Factor	1.00			
Electric Fuel Share	5.0%	Fossil Fuel Share	95.0%	

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	5.1
MJ/m².yr	198

Gas EUI	
kWh/ft².yr	9.3
MJ/m².yr	361

Market Composite EUI	
kWh/ft².yr	9.1
MJ/m².yr	353

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	0.0%	5.0%	20.0%	5.0%	70.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7	°C	44.6	°F
Condenser Water	30	°C	86	°F
Supply Air	14.0	°C	57.2	°F

Peak Cooling Load	87	W/m²	27	Btu/hr.ft²	436	ft²/Ton
Seasonal Cooling Load (Tertiary Load)	153.6	MJ/m².yr	4.0	kWh/ft².yr		

Sizing Factor 1.00 | Operation (occ. period) 3000 hrs/year | Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C) 80.0%

Electric Fuel Share 100.0% | Gas Fuel Share 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	1.8
MJ/m².yr	71

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	1.8
MJ/m².yr	71

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	60%				10%
Eff./COP	0.65				0.75

	Fossil		Elec. Res.
Fuel Share	70%		30%
Blended Efficiency	0.66		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 30.0

Wetting Use Percentage 90%

All Electric EUI	
kWh/ft².yr	0.9
MJ/m².yr	33

Fossil Fuel EUI	
kWh/ft².yr	1.2
MJ/m².yr	45

Market Composite EUI	
kWh/ft².yr	1.1
MJ/m².yr	41.5

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Medium Office	**50,000 to 100,000 ft²**		**Lower Mainland**
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	4.7	L/s.m²	0.92	CFM/ft²
System Static Pressure CAV	850	Pa	3.4	wg
System Static Pressure VAV	850	Pa	3.4	wg
Fan Efficiency	52%			
Fan Motor Efficiency	88%			
Sizing Factor	1.00			
Fan Design Load CAV	8.7	W/m²	0.81	W/ft²
Fan Design Load VAV	8.7	W/m²	0.81	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	50%	50%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	50%	50%	50%	50%
Comments:				

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.3	L/s.m²	0.05	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.4	L/s.m²	0.07	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.5	W/m²	0.05	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.020	kW/kW	0.07	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	1.73	W/m²	0.16	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.005	L/s.m²	0.007	U.S. gpm/ft²
Pump Head Pressure	45	kPa	15	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.52	W/m²	0.05	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.004	L/s.m²	0.0055	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.7	W/m²	0.07	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	43.9	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	3.0	kWh/m².yr
Condenser Pump Energy Consumption	0.4	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.8	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	3.7	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI	kWh/ft².yr	4.8
	MJ/m².yr	186.7

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Office	50,000 to 100,000 ft²		Lower Mainland
Baseline			

EUI SUMMARY

TOTAL ALL END-USES: **Electricity:** **16.3** kWh/ft².yr **630.7** MJ/m².yr **Fossil Fue** **10.4** kWh/ft².yr **404.5** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	4.6	176.9
ARCHITECTURAL LIGHTING	0.3	12.4
SPECIAL PURPOSE LIGHTING	0.0	0.0
OTHER PLUG LOADS	0.3	12.8
HVAC FANS & PUMPS	4.8	186.7
REFRIGERATION	0.1	4.0
COMPUTER EQUIPMENT	3.0	114.8
ELEVATORS	0.3	11.6
OUTDOOR LIGHTING	0.8	32.2

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.3	9.9	8.9	342.8
SPACE COOLING	1.5	56.5	0.0	0.0
DOMESTIC HOT WATER	0.3	9.9	0.8	31.6
FOOD SERVICE EQUIPMENT	0.1	3.0	0.3	10.0
MISCELLANEOUS	0.0	0.0	0.5	20.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Large Retail	**> 100,000 ft²**		**Lower Mainland**
Baseline			p

CONSTRUCTION

Wall U value (W/m².°C)	0.66 W/m².°C	0.12 Btu/hr.ft² . °F	Typical Building Size	24,000 m²	258,240 ft²
Roof U value (W/m².°C)	0.34 W/m².°C	0.06 Btu/hr.ft² . °F	Typical Footprint (m²)	24,000 m²	258,240 ft²
Glazing U value (W/m².°C)	3.50 W/m².°C	0.62 Btu/hr.ft² . °F	Footprint Aspect Ratio (L:W)	15	
			Percent Conditioned Space	100%	
			Percent Conditioned Space Defined as Exterior Zone	40%	
Window/Wall Ratio (WIWAR) (%)	0.10				
Shading Coefficient (SC)	0.78		Typical # Stories	1	
			Floor to Floor Height (m)	4.6 m	15.0 ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	80%		0%		20%		0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	45 m²/person	484 ft²/person	%OA 20.93%
Occupancy Schedule Occ. Period	90%		
Occupancy Schedule Unocc. Period	0%		
Fresh Air Requirements or Outside Air	50 L/s.person	106 CFM/person	

Fresh Air Control Type *(enter a 1, 2 or 3) 1
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right: 0%
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation 0.5 L/s.m² 0.10 CFM/ft²
50% operation (%)

Sizing Factor	2.3	
Total Air Circulation or Design Air Flow	5.31 L/s.m²	1.05 CFM/ft²
Infiltration Rate	0.38 L/s.m²	0.07 CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0 L/s.m²	0.00 CFM/ft²
Operation occupied period	50%	
Operation unoccupied period	50%	

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	7,875,583	
Peak Zone Sensible Load	2,523,126	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	117,376	
Total air circulation or Design air	5.31	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	23	°C	73.4	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	20.4	°C	68.72	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Retail	**> 100,000 ft^2**		**Lower Mainland**
Baseline			p

LIGHTING

GENERAL LIGHTING

Light Level	590	Lux	54.8	ft-candles
Floor Fraction (GLFF)	0.60			
Connected Load	15.2	W/m^2	1.4	W/ft^2
Occ. Period(Hrs./yr.)	4100			
Unocc. Period(Hrs./yr.)	4660			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	20%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	500	600	700	800	Total
% Distribution	10%	90%	0%	0%	100%
Weighted Average					**590**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)					100.0%			100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft^2.yr	4.1
	MJ/m^2.yr	159

ARCHITECTURAL LIGHTING

Light Level	575	Lux	53.4	ft-candles
Floor Fraction (ALFF)	0.15			
Connected Load	60.7	W/m^2	5.6	W/ft^2
Occ. Period(Hrs./yr.)	4100			
Unocc. Period(Hrs./yr.)	4660			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	30%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	400	500	600	700	Total
% Distribution	0%	25%	75%	0%	100%
Weighted Average					**575**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	60%	40%						100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft^2.yr	4.5
	MJ/m^2.yr	173

SPECIAL PURPOSE LIGHTING

Light Level	550.00	Lux	51.1	ft-candles
Floor Fraction (HBLFF)	0.25			
Connected Load	23.0	W/m^2	2.1	W/ft^2
Occ. Period(Hrs./yr.)	4100			
Unocc. Period(Hrs./yr.)	4660			
Usage During Occupied Period	100%			
Usage During Unoccupied Period	20%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 | 1.00

Light Level (Lux)	400	500	600	700	Total
% Distribution	0%	50%	50%	0%	100%
Weighted Average					**550**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)						100%		100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.7	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft^2.yr	2.7
	MJ/m^2.yr	104

TOTAL LIGHTING

Overall LPD	18.24 W/m^2	EUI TOTAL	kWh/ft^2.yr	11.3
	1.70 W/ft^2		MJ/m^2.yr	436

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Servers	Plug Loads
Measured Power (W/device)	55	51	100	200	217	
Density (device/occupant)	0.648828	0.648828	0.01	0.01	0.03	
Connected Load	0.8 W/m^2	0.7 W/m^2	0.0 W/m^2	0.0 W/m^2	0.5 W/m^2	1.75 W/m^2
	0.1 W/ft^2	0.1 W/ft^2	0.00 W/ft^2	0.00 W/ft^2	0.05 W/ft^2	0.16 W/ft^2
Diversity Occupied Period	90%	90%	90%	90%	100%	90%
Diversity Unoccupied Period	50%	50%	50%	50%	100%	25%
Operation Occ. Period (hrs./year)	2000	2000	2600	2600	2600	4100
Operation Unocc. Period (hrs./year)	6760	6760	6160	6160	6160	4660

Total end-use load (occupied period)	3.5	W/m^2	0.3	W/ft^2
Total end-use load (unocc. period)	1.7	W/m^2	0.2	W/ft^2
Usage during occupied period	100%			
Usage during unoccupied period	50%			

Computer Equipment	EUI	kWh/ft^2.yr	1.18
		MJ/m^2.yr	45.81
Plug Loads	EUI	kWh/ft^2.yr	0.79
		MJ/m^2.yr	30.59

FOOD SERVICE EQUIPMENT

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft^2.yr	0.3	EUI	kWh/ft^2.yr	0.3
	MJ/m^2.yr	10.0		MJ/m^2.yr	10.0

REFRIGERATION

Provide description below:

EUI	kWh/ft^2.yr	0.3
	MJ/m^2.yr	10.0

MISCELLANEOUS

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft^2.yr	0.1	EUI	kWh/ft^2.yr	0.0
	MJ/m^2.yr	5.0		MJ/m^2.yr	0.0

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Large Retail	**> 100,000 ft²**		**Lower Mainland**
Baseline			p

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)		5%		87%	0%	0%	2%	1%	5%	0%	100%
Seasonal Eff./COP	75%	80%	85%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff. (kW/kW)	1.33	1.25	1.18	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	18.3	W/m²	5.8	Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	111	MJ/m².yr	2.9	kWh/ft².yr
Sizing Factor	1.00			

Electric Fuel Share 8.0% Fossil Fuel Share 92.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	kWh/ft².yr	2.3
	MJ/m².yr	90
Gas EUI	kWh/ft².yr	3.8
	MJ/m².yr	148
Market Composite EUI	kWh/ft².yr	3.7
	MJ/m².yr	143

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	0.0%	3.0%	0.0%	3.0%	94.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7	°C	44.6	°F
Condenser Water	30	°C	86	°F
Supply Air	14.0	°C	57.2	°F

Peak Cooling Load	96	W/m²	30	Btu/hr.ft²	393	ft²/Ton
Seasonal Cooling Load (Tertiary Load)	154.7	MJ/m².yr	4.0	kWh/ft².yr		

Sizing Factor 1.00 Operation (occ. period) 3000 hrs/year Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C) 90.0%

Electric Fuel Share 100.0% Gas Fuel Share 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenan

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	kWh/ft².yr	1.5
	MJ/m².yr	60
Natural Gas EUI	kWh/ft².yr	0.0
	MJ/m².yr	0
Market Composite EUI	kWh/ft².yr	1.5
	MJ/m².yr	60

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	40%				10%
Eff./COP	0.65				0.75

	Fossil	Elec. Res.
Fuel Share	50%	50%
Blended Efficiency	0.67	0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 30.0

Wetting Use Percentage 90%

All Electric EUI		Fossil Fuel EUI		Market Composite EUI	
kWh/ft².yr	0.9	kWh/ft².yr	1.2	kWh/ft².yr	1.0
MJ/m².yr	33	MJ/m².yr	45	MJ/m².yr	38.9

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Large Retail	**> 100,000 ft²**		**Lower Mainland**
Baseline			p

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	5.3	L/s.m²	1.05	CFM/ft²
System Static Pressure CAV	650	Pa	2.6	wg
System Static Pressure VAV	650	Pa	2.6	wg
Fan Efficiency	60%			
Fan Motor Efficiency	80%			
Sizing Factor	1.00			
Fan Design Load CAV	7.2	W/m²	0.67	W/ft²
Fan Design Load VAV	7.2	W/m²	0.67	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	80%	20%	50%	50%
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	50%	50%	50%	50%
Comments:				

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.0	L/s.m²	0.00	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.1	L/s.m²	0.02	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.1	W/m²	0.01	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.027	kW/kW	0.09	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	2.60	W/m²	0.24	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.005	L/s.m²	0.008	U.S. gpm/ft²
Pump Head Pressure	0	kPa	0	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.00	W/m²	0.00	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.004	L/s.m²	0.0061	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.8	W/m²	0.08	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	41.0	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	0.9	kWh/m².yr
Condenser Pump Energy Consumption	0.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	1.0	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	4.1	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI	kWh/ft².yr	4.4
	MJ/m².yr	169.2

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Large Retail	**> 100,000 ft²**		**Lower Mainland**
Baseline			p

EUI SUMMARY

TOTAL ALL END-USES: **Electricity:** **21.7** kWh/ft².yr **841.9** MJ/m².yr **Fossil Fue** **4.5** kWh/ft².yr **173.2** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	4.1	158.9
ARCHITECTURAL LIGHTING	4.5	173.4
SPECIAL PURPOSE LIGHTING	2.7	104.0
OTHER PLUG LOADS	0.8	30.6
HVAC FANS & PUMPS	4.4	169.2
REFRIGERATION	0.3	10.0
COMPUTER EQUIPMENT	1.2	45.8
ELEVATORS	0.3	11.6
OUTDOOR LIGHTING	1.3	50.9

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.2	7.2	3.5	135.8
SPACE COOLING	1.4	53.8	0.0	0.0
DOMESTIC HOT WATER	0.4	16.5	0.6	22.4
FOOD SERVICE EQUIPMENT	0.3	10.0	0.3	10.0
MISCELLANEOUS	0.0	0.0	0.1	5.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Retail	50,000 - 100,000 ft2		Lower Mainland
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.59	W/m².°C	0.10	Btu/hr.ft² . °F	Typical Building Size	7,435	m²	80,000	ft²
Roof U value (W/m².°C)	0.32	W/m².°C	0.06	Btu/hr.ft² . °F	Typical Footprint (m²)	7,435	m²	80,000	ft²
Glazing U value (W/m².°C)	3.50	W/m².°C	0.62	Btu/hr.ft² . °F	Footprint Aspect Ratio (L:W)	5			
					Percent Conditioned Space	100%			
					Percent Conditioned Space Defined as Exterior Zone	45%			
Window/Wall Ratio (WIWAR) (%)	0.10								
Shading Coefficient (SC)	0.78				Typical # Stories	1			
					Floor to Floor Height (m)	5.0	m	16.5	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	100%		0%		0%		0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	25	m²/person	269	ft²/person	%OA	32.01%
Occupancy Schedule Occ. Period	90%					
Occupancy Schedule Unocc. Period	0%					
Fresh Air Requirements or Outside Air	40	L/s.person	85	CFM/person		

Fresh Air Control Type *(enter a 1, 2 or 3)	1	If Fresh Air Control Type = "2" enter % FA. to the right:	34%			
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)		If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation	0.5	L/s.m²	0.10	CFM/ft²
			50%	operation (%)		

Sizing Factor	2			
Total Air Circulation or Design Air Flow	5.00	L/s.m²	0.98	CFM/ft²
Infiltration Rate (air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)	0.42	L/s.m²	0.08	CFM/ft²

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	3,247,582	
Peak Zone Sensible Load	846,218	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	39,366	
Total air circulation or Design air	5.00	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	21	°C	69.8	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	21	°C	69.8	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning — Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Retail	50,000 - 100,000 ft2		Lower Mainland
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	590	Lux	54.8	ft-candles
Floor Fraction (GLFF)	0.55			
Connected Load	15.2	W/m^2	1.4	W/ft^2
Occ. Period(Hrs./yr.)	4100			
Unocc. Period(Hrs./yr.)	4660			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	20%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	500	600	700	800	Total
% Distribution	10%	90%	0%	0%	100%
Weighted Average					**590**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			0.0%	0%	100.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI kWh/ft^2.yr 3.8
MJ/m^2.yr 146

ARCHITECTURAL LIGHTING

Light Level	575	Lux	53.4	ft-candles
Floor Fraction (ALFF)	0.15			
Connected Load	63.6	W/m^2	5.9	W/ft^2
Occ. Period(Hrs./yr.)	4100			
Unocc. Period(Hrs./yr.)	4660			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	35%			
Fixture Cleaning:				
Incidence of Practice	95%			
Interval	20%	years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	400	500	600	700	Total
% Distribution	0%	25%	75%	0%	100%
Weighted Average					**575**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	65%	35%					0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI kWh/ft^2.yr 4.9
MJ/m^2.yr 190

EUI = Load X Hrs. X SF X GLFF

SPECIAL PURPOSE LIGHTING

Light Level	550.00	Lux	51.1	ft-candles
Floor Fraction (HBLFF)	0.30			
Connected Load	23.0	W/m^2	2.1	W/ft^2
Occ. Period(Hrs./yr.)	4100			
Unocc. Period(Hrs./yr.)	4660			
Usage During Occupied Period	100%			
Usage During Unoccupied Period	15%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 | 1.00

Light Level (Lux)	400	500	600	700	Total
% Distribution	0%	50%	50%	0%	100%
Weighted Average					**550**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)						100%		100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.7	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI kWh/ft^2.yr 3.1
MJ/m^2.yr 119

TOTAL LIGHTING

Overall LPD 17.92 W/m^2
1.67 W/ft^2

EUI TOTAL kWh/ft^2.yr 11.7
MJ/m^2.yr 454

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Servers		Plug Loads	
Measured Power (W/device)	55		51		100		200		217			
Density (device/occupant)	0.36046		0.36046		0.01		0.01		0.02			
Connected Load	0.8	W/m^2	0.7	W/m^2	0.0	W/m^2	0.1	W/m^2	0.5	W/m^2	1.15	W/m^2
	0.1	W/ft^2	0.1	W/ft^2	0.00	W/ft^2	0.01	W/ft^2	0.05	W/ft^2	0.11	W/ft^2
Diversity Occupied Period	90%		90%		90%		90%		100%		90%	
Diversity Unoccupied Period	50%		50%		50%		50%		100%		25%	
Operation Occ. Period (hrs./year)	2000		2000		2600		2600		2600		4100	
Operation Unocc. Period (hrs./year)	6760		6760		6160		6160		6160		4660	

Total end-use load (occupied period)	3.0	W/m^2	0.3	W/ft^2
Total end-use load (unocc. period)	1.6	W/m^2	0.2	W/ft^2
Usage during occupied period	100%			
Usage during unoccupied period	54%			

Computer Equipment	EUI	kWh/ft^2.yr	1.21
		MJ/m^2.yr	46.85
Plug Loads	EUI	kWh/ft^2.yr	0.52
		MJ/m^2.yr	20.10

FOOD SERVICE EQUIPMENT

Provide description below:
Small restaurants, food courts, kitchenettes

Gas EUI			Electric EUI		
EUI	kWh/ft^2.yr	0.1	EUI	kWh/ft^2.yr	0.1
	MJ/m^2.yr	5.0		MJ/m^2.yr	5.0

REFRIGERATION

Provide description below:

EUI kWh/ft^2.yr 0.2
MJ/m^2.yr 8.6

MISCELLANEOUS

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft^2.yr	0.3	EUI	kWh/ft^2.yr	0.0
	MJ/m^2.yr	10.0		MJ/m^2.yr	0.0

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **Medium Retail** **Baseline**
SIZE: **50,000 - 100,000 ft2**
VINTAGE:
REGION: **Lower Mainland**

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	0%	2%	0%	60%	30%	0%	3%	0%	5%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff. (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	15.4 W/m²	4.9 Btu/hr.ft²	
Seasonal Heating Load (Tertiary Load)	237 MJ/m².yr	6.1 kWh/ft².yr	
Sizing Factor	1.00		
Electric Fuel Share	8.0%	Fossil Fuel Share	92.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	5.2
MJ/m².yr	200

Gas EUI	
kWh/ft².yr	8.0
MJ/m².yr	308

Market Composite EUI	
kWh/ft².yr	7.7
MJ/m².yr	300

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	0.0%	3.0%	0.0%	3.0%	94.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7 °C	44.6 °F
Condenser Water	30 °C	86 °F
Supply Air	14.0 °C	57.2 °F

Peak Cooling Load	128 W/m²	41 Btu/hr.ft²	296 ft²/Ton
Seasonal Cooling Load (Tertiary Load)	194.2 MJ/m².yr	5.0 kWh/ft².yr	

Sizing Factor 1.00 — Operation (occ. period) 3000 hrs/year Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C) 90.0%

Electric Fuel Share 100.0% — Gas Fuel Share 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenan

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	2.1
MJ/m².yr	82

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	2.1
MJ/m².yr	82

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	35%				10%
Eff./COP	0.65				0.75

	Fossil		Elec. Res.
Fuel Share	45%		55%
Blended Efficiency	0.67		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 30.0

Wetting Use Percentage 90%

All Electric EUI	
kWh/ft².yr	0.9
MJ/m².yr	33

Fossil Fuel EUI	
kWh/ft².yr	1.2
MJ/m².yr	45

Market Composite EUI	
kWh/ft².yr	1.0
MJ/m².yr	38.2

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EXISTING BUILDINGS: **Medium Retail** **Baseline**
SIZE: **50,000 - 100,000 ft2**
VINTAGE:
REGION: **Lower Mainland**

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	5.0	L/s.m²	0.98	CFM/ft²
System Static Pressure CAV	500	Pa	2.0	wg
System Static Pressure VAV	500	Pa	2.0	wg
Fan Efficiency	60%			
Fan Motor Efficiency	88%			
Sizing Factor	1.00			
Fan Design Load CAV	4.7	W/m²	0.44	W/ft²
Fan Design Load VAV	4.7	W/m²	0.44	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	100%	0%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	75%	25%	50%	50%
Comments:				

EXHAUST FANS

Washroom Exhaust	50	L/s.washroom	106	CFM/washroom
Washroom Exhaust per gross unit are	0.0	L/s.m²	0.00	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.1	L/s.m²	0.02	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.2	W/m²	0.01	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.020	kW/kW	0.07	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	2.56	W/m²	0.24	W/ft²

Condenser Pump

Pump Design Flow	0.000	L/s.KW	0.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.000	L/s.m²	0.000	U.S. gpm/ft²
Pump Head Pressure	45	kPa	15	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.00	W/m²	0.00	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.006	L/s.m²	0.0081	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	0	kPa	0	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.0	W/m²	0.00	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	35.2	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	0.9	kWh/m².yr
Condenser Pump Energy Consumption	0.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	1.0	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	0.0	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI	kWh/ft².yr	3.5
	MJ/m².yr	133.8

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Medium Retail	**50,000 - 100,000 ft2**		**Lower Mainland**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**21.7**	kWh/ft².yr	**839.6**	MJ/m².yr	**Fossil Fue**	**8.2**	kWh/ft².yr	**318.9**	MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	3.8	145.7
ARCHITECTURAL LIGHTING	4.9	189.8
SPECIAL PURPOSE LIGHTING	3.1	119.0
OTHER PLUG LOADS	0.5	20.1
HVAC FANS & PUMPS	3.5	133.8
REFRIGERATION	0.2	8.6
COMPUTER EQUIPMENT	1.2	46.9
ELEVATORS	0.3	11.6
OUTDOOR LIGHTING	1.3	50.9

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.4	16.0	7.3	283.8
SPACE COOLING	1.9	74.2	0.0	0.0
DOMESTIC HOT WATER	0.5	18.1	0.5	20.1
FOOD SERVICE EQUIPMENT	0.1	5.0	0.1	5.0
MISCELLANEOUS	0.0	0.0	0.3	10.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Food Retail	0		Lower Mainland
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.64	W/m².°C	0.11	Btu/hr.ft² . °F
Roof U value (W/m².°C)	0.34	W/m².°C	0.06	Btu/hr.ft² . °F
Glazing U value (W/m².°C)	3.50	W/m².°C	0.62	Btu/hr.ft² . °F
Window/Wall Ratio (WIWAR) (%)	0.11			
Shading Coefficient (SC)	0.79			

Typical Building Size	4,000	m²	43,040	ft²
Typical Footprint (m²)	4,000	m²	43,040	ft²
Footprint Aspect Ratio (L:W)	1			
Percent Conditioned Space	100%			
Percent Conditioned Space Defined as Exterior Zone	40%			
Typical # Stories	1			
Floor to Floor Height (m)	7.0	m	23.0	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	100%		0%		0%		0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	45	m²/person	484	ft²/person
Occupancy Schedule Occ. Period	90%			
Occupancy Schedule Unocc. Period	0%			
Fresh Air Requirements or Outside Air	70	L/s.person	148	CFM/person

%OA 34.47%

Fresh Air Control Type *(enter a 1, 2 or 3) 1
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right: 0%
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation 0.5 L/s.m² 0.10 CFM/ft²
50% operation (%)

Sizing Factor	1.65			
Total Air Circulation or Design Air Flow	4.51	L/s.m²	0.89	CFM/ft²
Infiltration Rate	0.32	L/s.m²	0.06	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based	Total
Incidence of Use	0%		100%	100%
Switchover Point		KJ/kg.	18	°C
		Btu/lbm	64.4	°F

Summary of Design Parameters		
Peak Design Cooling Load	1,738,991	
Peak Zone Sensible Load	498,244	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	23,178	
Total air circulation or Design air	4.51	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	22	°C	71.6	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	20.4	°C	68.72	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Food Retail	**0**		**Lower Mainland**
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	600 Lux	55.8	ft-candles
Floor Fraction (GLFF)	0.40		
Connected Load	15.5 W/m²	1.4	W/ft²
Occ. Period(Hrs./yr.)	4100		
Unocc. Period(Hrs./yr.)	4660		
Usage During Occupied Period	100%		
Usage During Unoccupied Period	40%		
Fixture Cleaning:			
Incidence of Practice			
Interval	years		
Relamping Strategy & Incidence of Practice	Group	Spot	

Light Level (Lux)	500	600	700	800			Total
% Distribution	25%	50%	25%	0%			100%
Weighted Average							**600**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)					100.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	3.4
	MJ/m².yr	133

ARCHITECTURAL LIGHTING

Light Level	640 Lux	59.5	ft-candles
Floor Fraction (ALFF)	0.20		
Connected Load	47.8 W/m²	4.4	W/ft²
Occ. Period(Hrs./yr.)	4100		
Unocc. Period(Hrs./yr.)	4660		
Usage During Occupied Period	100%		
Usage During Unoccupied Period	50%		
Fixture Cleaning:			
Incidence of Practice			
Interval	years		
Relamping Strategy & Incidence of Practice	Group	Spot	

Light Level (Lux)	300	500	700	1000			Total
% Distribution	0%	30%	70%	0%			100%
Weighted Average							**640**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	30%	70%						100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	5.7
	MJ/m².yr	221

SPECIAL PURPOSE LIGHTING

Light Level	500.00 Lux	46.5	ft-candles
Floor Fraction (HBLFF)	0.40		
Connected Load	23.3 W/m²	2.2	W/ft²
Occ. Period(Hrs./yr.)	4100		
Unocc. Period(Hrs./yr.)	4660		
Usage During Occupied Period	100%		
Usage During Unoccupied Period	50%		
Fixture Cleaning:			
Incidence of Practice			
Interval	years		
Relamping Strategy & Incidence of Practice	Group	Spot	

Floor fraction check: should = 1.00 — 1.00

Light Level (Lux)	300	500	700	1000			Total
% Distribution	20%	60%	20%	0%			100%
Weighted Average							**500**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)						100%		100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	5.6
	MJ/m².yr	216

TOTAL LIGHTING

Overall LPD	15.76 W/m²	EUI TOTAL	kWh/ft².yr	14.7
	1.47 W/ft²		MJ/m².yr	570

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Servers		Plug Loads	
Measured Power (W/device)	55		51		100		200		217			
Density (device/occupant)	0.648828		0.648828		0.01		0.01		0.03			
Connected Load	0.8	W/m²	0.7	W/m²	0.0	W/m²	0.0	W/m²	0.5	W/m²	2.85	W/m²
	0.1	W/ft²	0.1	W/ft²	0.00	W/ft²	0.00	W/ft²	0.05	W/ft²	0.26	W/ft²
Diversity Occupied Period	90%		90%		90%		90%		100%		90%	
Diversity Unoccupied Period	50%		50%		50%		50%		100%		50%	
Operation Occ. Period (hrs./year)	2000		2000		2600		2600		2600		4100	
Operation Unocc. Period (hrs./year)	6760		6760		6160		6160		6160		4660	

Total end-use load (occupied period)	4.5 W/m²	0.4 W/ft²
Total end-use load (unocc. period)	2.7 W/m²	0.3 W/ft²
Usage during occupied period	100%	
Usage during unoccupied period	61%	

Computer Equipment	EUI	kWh/ft².yr	1.18
		MJ/m².yr	45.81
Plug Loads	EUI	kWh/ft².yr	1.59
		MJ/m².yr	61.77

FOOD SERVICE EQUIPMENT

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	2.3	EUI	kWh/ft².yr	0.4
	MJ/m².yr	90.0		MJ/m².yr	15.0

REFRIGERATION

Provide description below:

Commercial refrigeration display cases

EUI	kWh/ft².yr	29.0
	MJ/m².yr	1125.0

MISCELLANEOUS

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	0.5	EUI	kWh/ft².yr	0.0
	MJ/m².yr	20.0		MJ/m².yr	

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: Food Retail Baseline
SIZE: 0
VINTAGE:
REGION: Lower Mainland

SPACE HEATING

Heating Plant Type

	Fossil Fuel: Boilers Stan.	Boilers High	Boilers Cond.	Forced Air RTU	Forced Air Furnace	Unit Heater	Electric A/A HP	W. S. HP	Resistance	Other District Heat	Total
System Present (%)	3%	10%	2%	65%	10%	0%	4%	1%	5%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff. (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load: 21.2 W/m² — 6.7 Btu/hr.ft²
Seasonal Heating Load (Tertiary Load): 262 MJ/m².yr — 6.8 kWh/ft².yr
Sizing Factor: 1.00

Electric Fuel Share: 10.0% Fossil Fuel Share: 90.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

	All Electric EUI	Gas EUI	Market Composite EUI
kWh/ft².yr	5.2	8.9	8.5
MJ/m².yr	202	343	329

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers Standard	Centrifugal Chillers HE	WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers W. H.	Absorption Chillers CW	Total
System Present (%)	0.0%	0.0%	0.0%		100.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

	°C	°F
Chilled Water	7	44.6
Condenser Water	30	86
Supply Air	14.0	57.2

Peak Cooling Load: 127 W/m² — 40 Btu/hr.ft² — 297 ft²/Ton
Seasonal Cooling Load (Tertiary Load): 205.7 MJ/m².yr — 5.3 kWh/ft².yr

Sizing Factor: 1.00 Operation (occ. period) 3000 hrs/year Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C): 85.0%

Electric Fuel Share: 100.0% Gas Fuel Share: 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

	All Electric EUI	Natural Gas EUI	Market Composite EUI
kWh/ft².yr	1.9	0.0	1.9
MJ/m².yr	74	0	74

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	60%				5%
Eff./COP	0.65				0.75

	Fossil		Elec. Res.
Fuel Share	65%		35%
Blended Efficiency	0.66		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load): 65.0

Wetting Use Percentage: 90%

	All Electric EUI	Fossil Fuel EUI	Market Composite EUI
kWh/ft².yr	1.8	2.6	2.3
MJ/m².yr	71	99	89.2

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Food Retail	0		Lower Mainland
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	4.5	L/s.m²	0.89	CFM/ft²
System Static Pressure CAV	500	Pa	2.0	wg
System Static Pressure VAV	1000	Pa	4.0	wg
Fan Efficiency	60%			
Fan Motor Efficiency	80%			
Sizing Factor	1.00			
Fan Design Load CAV	4.7	W/m²	0.44	W/ft²
Fan Design Load VAV	9.4	W/m²	0.87	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	100%	0%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	40%	60%	100%	0%

Comments:

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m²	0.01	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.2	L/s.m²	0.03	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.2	W/m²	0.02	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.027	kW/kW	0.09	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	3.44	W/m²	0.32	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.007	L/s.m²	0.010	U.S. gpm/ft²
Pump Head Pressure	0	kPa	0	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.00	W/m²	0.00	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.005	L/s.m²	0.0081	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	0	kPa	0	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.0	W/m²	0.00	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	26.3	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	1.8	kWh/m².yr
Condenser Pump Energy Consumption	0.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	1.2	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	0.0	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI		
	kWh/ft².yr	2.7
	MJ/m².yr	105.5

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Food Retail	0		Lower Mainland
Baseline			

EUI SUMMARY

TOTAL ALL END-USES: **Electricity:** **53.6** kWh/ft².yr **2,076.6** MJ/m².yr **Fossil Fue** **12.5** kWh/ft².yr **483.3** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	3.4	133.1
ARCHITECTURAL LIGHTING	5.7	221.4
SPECIAL PURPOSE LIGHTING	5.6	215.8
OTHER PLUG LOADS	1.6	61.8
HVAC FANS & PUMPS	2.7	105.5
REFRIGERATION	29.0	1,125.0
COMPUTER EQUIPMENT	1.2	45.8
ELEVATORS	0.3	11.6
OUTDOOR LIGHTING	0.9	33.9

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.5	20.2	8.0	309.1
SPACE COOLING	1.6	62.5	0.0	0.0
DOMESTIC HOT WATER	0.6	25.0	1.7	64.2
FOOD SERVICE EQUIPMENT	0.4	15.0	2.3	90.0
MISCELLANEOUS	0.0	0.0	0.5	20.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Hotel	0		Lower Mainland
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.82 W/m².°C	0.14 Btu/hr.ft² . °F		
Roof U value (W/m².°C)	0.34 W/m².°C	0.06 Btu/hr.ft² . °F		
Glazing U value (W/m².°C)	3.50 W/m².°C	0.62 Btu/hr.ft² . °F		
Window/Wall Ratio (WIWAR) (%)	0.30			
Shading Coefficient (SC)	0.65			

Typical Building Size	20,000 m²	215,200 ft²
Typical Footprint (m²)	2,000 m²	21,520 ft²
Footprint Aspect Ratio (L:W)	3	
Percent Conditioned Space	100%	
Percent Conditioned Space Defined as Exterior Zone	45%	
Typical # Stories	10	
Floor to Floor Height (m)	3.7 m	12.0 ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	66%		0%		0%	34%	0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	60 m²/person	646 ft²/person	%OA 34.69%
Occupancy Schedule Occ. Period	45%		
Occupancy Schedule Unocc. Period	80%		
Fresh Air Requirements or Outside Air	70 L/s.person	148 CFM/person	

Fresh Air Control Type *(enter a 1, 2 or 3): 1
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right: 15%
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation: 0.5 L/s.m² | 0.10 CFM/ft²
50% operation (%)

Sizing Factor	1.6	
Total Air Circulation or Design Air Flow	3.36 L/s.m²	0.66 CFM/ft²
Infiltration Rate	0.38 L/s.m²	0.07 CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0 L/s.m²	0.00 CFM/ft²
Operation occupied period	50%	
Operation unoccupied period	50%	

Economizer

	Enthalpy Based		Dry-Bulb Based	Total
Incidence of Use	0%		100%	100%
Switchover Point		KJ/kg.	18 °C	
		Btu/lbm	64.4 °F	

Summary of Design Parameters		
Peak Design Cooling Load	6,529,412	
Peak Zone Sensible Load	1,914,862	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	89,079	
Total air circulation or Design air	3.36	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	23	°C	73.4	°F	15	°C	59	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	20.6	°C	69.08	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning — Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Hotel	0		Lower Mainland
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	248	Lux	23.0	ft-candles
Floor Fraction (GLFF)	0.20			
Connected Load	6.4	W/m²	0.6	W/ft²
Occ. Period(Hrs./yr.)	3000			
Unocc. Period(Hrs./yr.)	5760			
Usage During Occupied Period	85%			
Usage During Unoccupied Period	90%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	125	300	400	500				Total
% Distribution	30%	70%						100%
Weighted Average								**247.5**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			0.0%		100.0%			100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	0.9
	MJ/m².yr	36

ARCHITECTURAL LIGHTING

Light Level	220	Lux	20.4	ft-candles
Floor Fraction (ALFF)	0.80			
Connected Load	15.3	W/m²	1.4	W/ft²
Occ. Period(Hrs./yr.)	2500			
Unocc. Period(Hrs./yr.)	6260			
Usage During Occupied Period	60%			
Usage During Unoccupied Period	40%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	100	200	300	400				Total
% Distribution	20%	50%	20%	10%				100%
Weighted Average								**220**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	25%	75%						100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	4.6
	MJ/m².yr	177

SPECIAL PURPOSE LIGHTING

Light Level	0.00	Lux	0.0	ft-candles
Floor Fraction (HBLFF)	0.00			
Connected Load	0.0	W/m²	0.0	W/ft²
Occ. Period(Hrs./yr.)	4000			
Unocc. Period(Hrs./yr.)	4760			
Usage During Occupied Period	0%			
Usage During Unoccupied Period	100%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 | 1.00

Light Level (Lux)	300	500	700	1000				Total
% Distribution		0%	0%	0%				0%
Weighted Average								**0**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)								0.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	0.0
	MJ/m².yr	0

TOTAL LIGHTING

Overall LPD	13.53 W/m²	EUI TOTAL	kWh/ft².yr	5.5
	1.26 W/ft²		MJ/m².yr	212

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Servers		Plug Loads	
Measured Power (W/device)	55		51		100		200		217			
Density (device/occupant)	0.3		0.3		0.05		0.033		0.03			
Connected Load	0.3	W/m²	0.3	W/m²	0.1	W/m²	0.1	W/m²	0.5	W/m²	2.2	W/m²
	0.0	W/ft²	0.0	W/ft²	0.01	W/ft²	0.01	W/ft²	0.05	W/ft²	0.20	W/ft²
Diversity Occupied Period	90%		90%		90%		90%		100%		70%	
Diversity Unoccupied Period	50%		50%		50%		50%		100%		25%	
Operation Occ. Period (hrs./year)	2500		2500		2500		2500		2500		3000	
Operation Unocc. Period (hrs./year)	6260		6260		6260		6260		6260		5760	

Total end-use load (occupied period)	2.7	W/m²	0.3	W/ft²
Total end-use load (unocc. period)	1.4	W/m²	0.1	W/ft²
Usage during occupied period	100%			
Usage during unoccupied period	53%			

Computer Equipment	EUI	kWh/ft².yr	0.78
		MJ/m².yr	30.14
Plug Loads	EUI	kWh/ft².yr	0.72
		MJ/m².yr	28.04

FOOD SERVICE EQUIPMENT

Provide description below:

Commercial food preparation

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	2.6	EUI	kWh/ft².yr	0.5
	MJ/m².yr	100.0		MJ/m².yr	17.5

REFRIGERATION

Provide description below:

Walk-in coolers/freezers, reach-in coolers/freezers, refrigerated buffet cases

EUI	kWh/ft².yr	0.6
	MJ/m².yr	25.0

MISCELLANEOUS

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	1.5	EUI	kWh/ft².yr	0.0
	MJ/m².yr	60.0		MJ/m².yr	0.0

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Hotel	0		Lower Mainland
Baseline			

SPACE HEATING

Heating Plant Type

							Electric			Other	
				Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	5%	55%	10%	15%	0%	0%	5%	2%	8%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff. (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	19.5 W/m²	6.2 Btu/hr.ft²	
Seasonal Heating Load (Tertiary Load)	245 MJ/m².yr	6.3 kWh/ft².yr	
Sizing Factor	1.00		
Electric Fuel Share	15.0%	Fossil Fuel Share	85.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	4.9
MJ/m².yr	189

Gas EUI	
kWh/ft².yr	7.9
MJ/m².yr	307

Market Composite EUI	
kWh/ft².yr	7.5
MJ/m².yr	289

SPACE COOLING

A/C Plant Type

			WSHP			Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	0.0%	33.3%	0.0%	33.3%	33.4%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7 °C	44.6 °F
Condenser Water	30 °C	86 °F
Supply Air	15.0 °C	59 °F

Peak Cooling Load	86 W/m²	27 Btu/hr.ft²	439 ft²/Ton
Seasonal Cooling Load (Tertiary Load)	141.5 MJ/m².yr	3.7 kWh/ft².yr	

Sizing Factor 0.90 — Operation (occ. period) 3000 hrs/year — Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C) 80.0%

Electric Fuel Share 100.0% — Gas Fuel Share 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	1.4
MJ/m².yr	56

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	1.4
MJ/m².yr	56

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	20%				60%
Eff./COP	0.65				0.75

	Fossil		Elec. Res.
Fuel Share	80%		20%
Blended Efficiency	0.73		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 225.0

Wetting Use Percentage 90%

All Electric EUI	
kWh/ft².yr	6.4
MJ/m².yr	247

Fossil Fuel EUI	
kWh/ft².yr	8.0
MJ/m².yr	310

Market Composite EUI	
kWh/ft².yr	7.7
MJ/m².yr	297.7

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EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Hotel	0		Lower Mainland
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	3.4	L/s.m²	0.66	CFM/ft²
System Static Pressure CAV	500	Pa	2.0	wg
System Static Pressure VAV	750	Pa	3.0	wg
Fan Efficiency	60%			
Fan Motor Efficiency	70%			
Sizing Factor	1.00			
Fan Design Load CAV	4.0	W/m²	0.37	W/ft²
Fan Design Load VAV	6.0	W/m²	0.56	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	66%	0%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	75%	25%	100%	0%
Comments:				

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m²	0.02	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.2	L/s.m²	0.04	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.3	W/m²	0.02	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.023	kW/kW	0.08	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	1.96	W/m²	0.18	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.005	L/s.m²	0.007	U.S. gpm/ft²
Pump Head Pressure	45	kPa	15	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.51	W/m²	0.05	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.004	L/s.m²	0.0055	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.7	W/m²	0.07	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	19.7	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	2.3	kWh/m².yr
Condenser Pump Energy Consumption	1.2	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.8	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	3.7	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI		
	kWh/ft².yr	2.6
	MJ/m².yr	99.9

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Hotel	0		Lower Mainland
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**14.6**	kWh/ft².yr	**567.3**	MJ/m².yr	**Fossil Fue**	**17.3** kWh/ft².yr	**669.1** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr	END USE:	Electricity		Fossil Fuel	
				kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	0.9	35.6					
ARCHITECTURAL LIGHTING	4.6	176.6	SPACE HEATING	0.7	28.4	6.7	260.8
SPECIAL PURPOSE LIGHTING	0.0	0.0	SPACE COOLING	1.2	44.8	0.0	0.0
OTHER PLUG LOADS	0.7	28.0	DOMESTIC HOT WATER	1.3	49.5	6.4	248.3
HVAC FANS & PUMPS	2.6	99.9	FOOD SERVICE EQUIPMENT	0.5	17.5	2.6	100.0
REFRIGERATION	0.6	25.0	MISCELLANEOUS	0.0	0.0	1.5	60.0
COMPUTER EQUIPMENT	0.8	30.1					
ELEVATORS	0.3	11.6					
OUTDOOR LIGHTING	0.5	20.4					

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Hotel	50,000 to 100,000 ft²		Lower Mainland
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.78	W/m².°C	0.14	Btu/hr.ft² . °F	Typical Building Size	6,000	m²	64,560	ft²
Roof U value (W/m².°C)	0.33	W/m².°C	0.06	Btu/hr.ft² . °F	Typical Footprint (m²)	1,500	m²	16,140	ft²
Glazing U value (W/m².°C)	3.50	W/m².°C	0.62	Btu/hr.ft² . °F	Footprint Aspect Ratio (L:W)	4			
					Percent Conditioned Space	100%			
					Percent Conditioned Space Defined as Exterior Zone	45%			
Window/Wall Ratio (WIWAR) (%)	0.40								
Shading Coefficient (SC)	0.57				Typical # Stories	4			
					Floor to Floor Height (m)	3.7	m	12.0	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	66%		0%		0%	34%	0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	50	m²/person	538	ft²/person	%OA 24.59%
Occupancy Schedule Occ. Period	50%				
Occupancy Schedule Unocc. Period	80%				
Fresh Air Requirements or Outside Air	40	L/s.person	85	CFM/person	

Fresh Air Control Type *(enter a 1, 2 or 3) | 1 | If Fresh Air Control Type = "2" enter % FA. to the right: | 15%

(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air) | If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation | 0.5 L/s.m² | 0.10 CFM/ft² | 50% operation (%)

Sizing Factor	1.4			
Total Air Circulation or Design Air Flow	3.25	L/s.m²	0.64	CFM/ft²
Infiltration Rate (air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)	0.50	L/s.m²	0.10	CFM/ft²

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	1,591,680	
Peak Zone Sensible Load	634,970	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	29,539	
Total air circulation or Design air	3.25	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	22	°C	71.6	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	21	°C	69.8	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning — Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Hotel	50,000 to 100,000 ft²		Lower Mainland
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	239	Lux	22.2	ft-candles
Floor Fraction (GLFF)	0.20			
Connected Load	6.2	W/m²	0.6	W/ft²

Occ. Period(Hrs./yr.)	3000
Unocc. Period(Hrs./yr.)	5760
Usage During Occupied Period	75%
Usage During Unoccupied Period	75%
Fixture Cleaning:	
Incidence of Practice	
Interval	years
Relamping Strategy & Incidence of Practice	Group / Spot

Light Level (Lux)	125	300	700	1000				Total
% Distribution	35%	65%	0%	0%				100%
Weighted Average								**238.75**
	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)					100.0%			100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	0.8
	MJ/m².yr	29

ARCHITECTURAL LIGHTING

Light Level	151	Lux	14.1	ft-candles
Floor Fraction (ALFF)	0.80			
Connected Load	11.8	W/m²	1.1	W/ft²

Occ. Period(Hrs./yr.)	2100
Unocc. Period(Hrs./yr.)	6660
Usage During Occupied Period	45%
Usage During Unoccupied Period	60%
Fixture Cleaning:	
Incidence of Practice	
Interval	years
Relamping Strategy & Incidence of Practice	Group / Spot

Light Level (Lux)	100	125	150	300				Total
% Distribution	0%	85%	0%	15%				100%
Weighted Average								**151.25**
	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	33%	67%						100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	4.3
	MJ/m².yr	167

SPECIAL PURPOSE LIGHTING

Light Level	0.00	Lux	0.0	ft-candles
Floor Fraction (HBLFF)	0.00			
Connected Load	0.0	W/m²	0.0	W/ft²

Floor fraction check: should = 1.00 | 1.00

Occ. Period(Hrs./yr.)	4000
Unocc. Period(Hrs./yr.)	4760
Usage During Occupied Period	0%
Usage During Unoccupied Period	100%
Fixture Cleaning:	
Incidence of Practice	
Interval	years
Relamping Strategy & Incidence of Practice	Group / Spot

Light Level (Lux)	300	500	700	1000				Total
% Distribution		0%	0%	0%				0%
Weighted Average								**0**
	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)								0.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	0.0
	MJ/m².yr	0

TOTAL LIGHTING

Overall LPD	10.65 W/m²	EUI TOTAL	kWh/ft².yr	5.1
	0.99 W/ft²		MJ/m².yr	197

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Servers	Plug Loads
Measured Power (W/device)	55	51	100	200	217	
Density (device/occupant)	0.3	0.3	0.05	0.033	0.03	
Connected Load	0.3 W/m²	0.3 W/m²	0.1 W/m²	0.1 W/m²	0.5 W/m²	2.1 W/m²
	0.0 W/ft²	0.0 W/ft²	0.01 W/ft²	0.01 W/ft²	0.05 W/ft²	0.20 W/ft²
Diversity Occupied Period	90%	90%	90%	90%	100%	70%
Diversity Unoccupied Period	50%	50%	50%	50%	100%	25%
Operation Occ. Period (hrs./year)	2500	2500	2500	2500	2500	3000
Operation Unocc. Period (hrs./year)	6260	6260	6260	6260	6260	5760

Total end-use load (occupied period)	2.8 W/m²	0.3 W/ft²
Total end-use load (unocc. period)	1.5 W/m²	0.1 W/ft²
Usage during occupied period	100%	
Usage during unoccupied period	53%	

Computer Equipment	EUI	kWh/ft².yr	0.85
		MJ/m².yr	32.93
Plug Loads	EUI	kWh/ft².yr	0.69
		MJ/m².yr	26.76

FOOD SERVICE EQUIPMENT

Provide description below:

Kitchen services

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	1.5	EUI	kWh/ft².yr	1.0
	MJ/m².yr	60.0		MJ/m².yr	40.0

REFRIGERATION

Provide description below:

Walk-in coolers/freezers, reach-in coolers/freezers, refrigerated buffet cases

EUI	kWh/ft².yr	0.6
	MJ/m².yr	25.0

MISCELLANEOUS

Provide description below:

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	1.5	EUI	kWh/ft².yr	0.0
	MJ/m².yr	60.0		MJ/m².yr	0.0

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Hotel	50,000 to 100,000 ft²		Lower Mainland
Baseline			

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	5%	5%	5%	45%	0%	0%	2%	0%	38%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff. (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	29.5 W/m²	9.4 Btu/hr.ft²	
Seasonal Heating Load (Tertiary Load)	234 MJ/m².yr	6.0 kWh/ft².yr	
Sizing Factor	1.00		
Electric Fuel Share	40.0%	Fossil Fuel Share	60.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	5.9
MJ/m².yr	229

Gas EUI	
kWh/ft².yr	7.9
MJ/m².yr	306

Market Composite EUI	
kWh/ft².yr	7.1
MJ/m².yr	275

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	0.0%	0.0%	0.0%	25.0%	75.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7 °C	44.6 °F
Condenser Water	30 °C	86 °F
Supply Air	14.0 °C	57.2 °F

Peak Cooling Load	66 W/m²	21 Btu/hr.ft²	573 ft²/Ton
Seasonal Cooling Load (Tertiary Load)	129.4 MJ/m².yr	3.3 kWh/ft².yr	

Sizing Factor 0.85 — Operation (occ. period) 3000 hrs/year Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C) 60.0%

Electric Fuel Share 100.0% — Gas Fuel Share 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	1.4
MJ/m².yr	55

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	1.4
MJ/m².yr	55

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Std. Tank	PV Tank	Cond. Tnk	Std. Boiler	Cnd. Boil.
System Present (%)	40%				30%
Eff./COP	0.65				0.75

	Fossil		Elec. Res.
Fuel Share	70%		30%
Blended Efficiency	0.69		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 225.0

Wetting Use Percentage 90%

All Electric EUI	
kWh/ft².yr	6.4
MJ/m².yr	247

Fossil Fuel EUI	
kWh/ft².yr	8.4
MJ/m².yr	325

Market Composite EUI	
kWh/ft².yr	7.8
MJ/m².yr	301.5

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **Medium Hotel** **Baseline**

SIZE: **50,000 to 100,000 ft²**

VINTAGE:

REGION: **Lower Mainland**

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	3.3	L/s.m²	0.64	CFM/ft²
System Static Pressure CAV	250	Pa	1.0	wg
System Static Pressure VAV	250	Pa	1.0	wg
Fan Efficiency	45%			
Fan Motor Efficiency	70%			
Sizing Factor	1.00			
Fan Design Load CAV	2.6	W/m²	0.24	W/ft²
Fan Design Load VAV	2.6	W/m²	0.24	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	66%	0%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	80%	20%	100%	0%

Comments:

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m²	0.03	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.2	L/s.m²	0.05	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.3	W/m²	0.03	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.027	kW/kW	0.09	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	1.78	W/m²	0.17	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.004	L/s.m²	0.005	U.S. gpm/ft²
Pump Head Pressure	45	kPa	15	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.39	W/m²	0.04	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.003	L/s.m²	0.0042	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.6	W/m²	0.05	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	13.1	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	2.7	kWh/m².yr
Condenser Pump Energy Consumption	1.1	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.9	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	2.8	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI	kWh/ft².yr	1.9
	MJ/m².yr	74.8

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Medium Hotel	**50,000 to 100,000 ft²**		**Lower Mainland**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**16.1**	kWh/ft².yr	**623.5**	MJ/m².yr	**Fossil Fue**	**13.7** kWh/ft².yr	**530.8** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	0.8	29.2
ARCHITECTURAL LIGHTING	4.3	167.5
SPECIAL PURPOSE LIGHTING	0.0	0.0
OTHER PLUG LOADS	0.7	26.8
HVAC FANS & PUMPS	1.9	74.8
REFRIGERATION	0.6	25.0
COMPUTER EQUIPMENT	0.9	32.9
ELEVATORS	0.3	11.6
OUTDOOR LIGHTING	0.4	17.0

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	2.4	91.6	4.7	183.4
SPACE COOLING	0.9	33.1	0.0	0.0
DOMESTIC HOT WATER	1.9	74.2	5.9	227.3
FOOD SERVICE EQUIPMENT	1.0	40.0	1.5	60.0
MISCELLANEOUS	0.0	0.0	1.5	60.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Hospital	0		Lower Mainland
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.63	W/m².°C	0.11	Btu/hr.ft² . °F
Roof U value (W/m².°C)	0.34	W/m².°C	0.06	Btu/hr.ft² . °F
Glazing U value (W/m².°C)	3.50	W/m².°C	0.62	Btu/hr.ft² . °F
Window/Wall Ratio (WIWAR) (%)	0.20			
Shading Coefficient (SC)	0.66			

Typical Building Size	14,000	m²	150,640	ft²
Typical Footprint (m²)	1,400	m²	15,064	ft²
Footprint Aspect Ratio (L:W)	2			
Percent Conditioned Space	100%			
Percent Conditioned Space Defined as Exterior Zone	45%			
Typical # Stories	8			
Floor to Floor Height (m)	4.3	m	14.0	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	50%		0%		20%	30%	0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	30	m²/person	323	ft²/person
Occupancy Schedule Occ. Period	90%			
Occupancy Schedule Unocc. Period	75%			
Fresh Air Requirements or Outside Air	57	L/s.person	121	CFM/person

%OA 40.18%

Fresh Air Control Type *(enter a 1, 2 or 3) | 1
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right: 15%
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation: 0.5 L/s.m² | 0.10 CFM/ft² | 50% operation (%)

Sizing Factor	2.3			
Total Air Circulation or Design Air Flow	4.73	L/s.m²	0.93	CFM/ft²
Infiltration Rate	0.32	L/s.m²	0.06	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	5,570,388	
Peak Zone Sensible Load	1,311,123	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	60,993	
Total air circulation or Design air	4.73	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	24	°C	75.2	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	22	°C	71.6	°F	16	°C	60.8	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	22	°C	71.6	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning — Changes/Year:

Incidence of Annual Room Controls Maintenance:

Incidence of Annual HVAC Controls Maintenance:

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Hospital	0		Lower Mainland
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	475	Lux	44.1	ft-candles
Floor Fraction (GLFF)	0.95			
Connected Load	12.3	W/m²	1.1	W/ft²
Occ. Period(Hrs./yr.)	3100			
Unocc. Period(Hrs./yr.)	5660			
Usage During Occupied Period	80%			
Usage During Unoccupied Period	35%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	100	250	700	800				Total
% Distribution		50%	50%	0%				100%
Weighted Average								**475**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)					100.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	4.8
	MJ/m².yr	187

ARCHITECTURAL LIGHTING

Light Level	250	Lux	23.2	ft-candles
Floor Fraction (ALFF)	0.05			
Connected Load	21.2	W/m²	2.0	W/ft²
Occ. Period(Hrs./yr.)	4000			
Unocc. Period(Hrs./yr.)	4760			
Usage During Occupied Period	90%			
Usage During Unoccupied Period	75%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	200	300	500	700				Total
% Distribution	50%	50%	0%	0%				100%
Weighted Average								**250**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	40%	60%						100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	0.7
	MJ/m².yr	27

SPECIAL PURPOSE LIGHTING

Light Level	0.00	Lux	0.0	ft-candles
Floor Fraction (HBLFF)	0.00			
Connected Load	0.0	W/m²	0.0	W/ft²
Occ. Period(Hrs./yr.)	4000			
Unocc. Period(Hrs./yr.)	4760			
Usage During Occupied Period	0%			
Usage During Unoccupied Period	100%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 | 1.00

Light Level (Lux)	300	500	700	1000				Total
% Distribution		0%	0%	0%				0%
Weighted Average								**0**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)								0.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	0.0
	MJ/m².yr	0

TOTAL LIGHTING

Overall LPD	12.72 W/m²	EUI TOTAL	kWh/ft².yr	5.5
	1.18 W/ft²		MJ/m².yr	215

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Servers		Plug Loads	
Measured Power (W/device)	55		51		100		200		217			
Density (device/occupant)	0.477744		0.477744		0.02		0.02		0.04			
Connected Load	0.9	W/m²	0.8	W/m²	0.1	W/m²	0.1	W/m²	0.5	W/m²	3.85	W/m²
	0.1	W/ft²	0.1	W/ft²	0.01	W/ft²	0.01	W/ft²	0.05	W/ft²	0.36	W/ft²
Diversity Occupied Period	90%		90%		90%		90%		100%		90%	
Diversity Unoccupied Period	50%		50%		50%		50%		100%		25%	
Operation Occ. Period (hrs./year)	2000		2000		2600		2600		2600		4100	
Operation Unocc. Period (hrs./year)	6760		6760		6160		6160		6160		4660	

Total end-use load (occupied period)	5.7	W/m²	0.5	W/ft²
Total end-use load (unocc. period)	2.4	W/m²	0.2	W/ft²
Usage during occupied period	100%			
Usage during unoccupied period	43%			

Computer Equipment	EUI	kWh/ft².yr	1.33
		MJ/m².yr	51.37
Plug Loads	EUI	kWh/ft².yr	1.74
		MJ/m².yr	67.29

FOOD SERVICE EQUIPMENT

Provide description below:

Commercial food services

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	1.8	EUI	kWh/ft².yr	0.1
	MJ/m².yr	70.0		MJ/m².yr	2.0

REFRIGERATION

Provide description below:

Walk-in coolers/freezers, reach-in coolers/freezers, refrigerated buffet cases

EUI	kWh/ft².yr	0.4
	MJ/m².yr	15.0

MISCELLANEOUS

Provide description below:

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	6.5	EUI	kWh/ft².yr	0.0
	MJ/m².yr	250.0		MJ/m².yr	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Hospital	0		Lower Mainland
Baseline			

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	10%	75%	8%	5%	0%	0%	0%	0%	2%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff. (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	21.6	W/m²	6.9	Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	584	MJ/m².yr	15.1	kWh/ft².yr
Sizing Factor	1.00			
Electric Fuel Share	2.0%	Fossil Fuel Share	98.0%	

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI		
	kWh/ft².yr	15.1
	MJ/m².yr	584
Gas EUI		
	kWh/ft².yr	18.9
	MJ/m².yr	730
Market Composite EUI		
	kWh/ft².yr	18.8
	MJ/m².yr	727

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7	°C	44.6	°F
Condenser Water	30	°C	86	°F
Supply Air	14.0	°C	57.2	°F

Peak Cooling Load	76	W/m²	24	Btu/hr.ft²	499	ft²/Ton
Seasonal Cooling Load (Tertiary Load)	169.3	MJ/m².yr	4.4	kWh/ft².yr		

Sizing Factor 0.65 — Operation (occ. period) 3000 hrs/year — Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C) 90.0%

Electric Fuel Share 100.0% — Gas Fuel Share 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenan

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI		
	kWh/ft².yr	1.2
	MJ/m².yr	47
Natural Gas EUI		
	kWh/ft².yr	0.0
	MJ/m².yr	0
Market Composite EUI		
	kWh/ft².yr	1.2
	MJ/m².yr	47

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	10%				80%
Eff./COP	0.65				0.80

	Fossil		Elec. Res.
Fuel Share	90%		10%
Blended Efficiency	0.78		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 250.0

Wetting Use Percentage 90%

All Electric EUI			Fossil Fuel EUI			Market Composite EUI		
kWh/ft².yr	7.1		kWh/ft².yr	8.2		kWh/ft².yr	8.1	
MJ/m².yr	275		MJ/m².yr	319		MJ/m².yr	314.7	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Hospital	0		Lower Mainland
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	4.7	L/s.m²	0.93	CFM/ft²
System Static Pressure CAV	1500	Pa	6.0	wg
System Static Pressure VAV	1100	Pa	4.4	wg
Fan Efficiency	55%			
Fan Motor Efficiency	89%			
Sizing Factor	1.00			
Fan Design Load CAV	14.5	W/m²	1.35	W/ft²
Fan Design Load VAV	10.6	W/m²	0.99	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	50%	20%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	50%	50%	100%	0%
Comments:				

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m²	0.03	CFM/ft²
Other Exhaust (Smoking/Conference)	0.5	L/s.m²	0.10	CFM/ft²
Total Building Exhaust	0.6	L/s.m²	0.13	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.9	W/m²	0.08	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.013	kW/kW	0.05	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	0.99	W/m²	0.09	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.004	L/s.m²	0.006	U.S. gpm/ft²
Pump Head Pressure	100	kPa	33.333333	ft
Pump Efficiency	60%			
Pump Motor Efficiency	88%			
Sizing Factor	1.0			
Pump Connected Load	0.76	W/m²	0.07	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.003	L/s.m²	0.0048	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	60%					
Pump Motor Efficiency	88%					
Sizing Factor	0.8					
Pump Connected Load	0.5	W/m²	0.05	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	52.9	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	7.5	kWh/m².yr
Condenser Pump Energy Consumption	2.5	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.5	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	2.5	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI		
	kWh/ft².yr	6.1
	MJ/m².yr	237.2

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Hospital	0		Lower Mainland
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	Electricity:	18.4 kWh/ft².yr	712.9 MJ/m².yr	Fossil Fuel	34.2 kWh/ft².yr	1,323.0 MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	4.8	187.2
ARCHITECTURAL LIGHTING	0.7	27.4
SPECIAL PURPOSE LIGHTING	0.0	0.0
OTHER PLUG LOADS	1.7	67.3
HVAC FANS & PUMPS	6.1	237.2
REFRIGERATION	0.4	15.0
COMPUTER EQUIPMENT	1.3	51.4
ELEVATORS	0.3	11.6
OUTDOOR LIGHTING	0.8	32.2

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.3	11.7	18.5	715.8
SPACE COOLING	1.1	42.4	0.0	0.0
DOMESTIC HOT WATER	0.7	27.5	7.4	287.2
FOOD SERVICE EQUIPMENT	0.1	2.0	1.8	70.0
MISCELLANEOUS	0.0	0.0	6.5	250.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **Nursing Home** **Baseline**
SIZE: **50,000 to 100,000 ft²**
VINTAGE:
REGION: **Lower Mainland**

CONSTRUCTION

Wall U value (W/m².°C)	0.61	W/m².°C	0.11	Btu/hr.ft² . °F
Roof U value (W/m².°C)	0.34	W/m².°C	0.06	Btu/hr.ft² . °F
Glazing U value (W/m².°C)	3.50	W/m².°C	0.62	Btu/hr.ft² . °F
Window/Wall Ratio (WIWAR) (%)	0.28			
Shading Coefficient (SC)	0.60			

Typical Building Size	8,364	m²	90,000	ft²
Typical Footprint (m²)	4,182	m²	45,000	ft²
Footprint Aspect Ratio (L:W)	7			
Percent Conditioned Space	100%			
Percent Conditioned Space Defined as Exterior Zone	45%			
Typical # Stories	2			
Floor to Floor Height (m)	3.7	m	12.0	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	90%		0%		10%	0%	0%		100%
Min. Air Flow (%)					60%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	30	m²/person	323	ft²/person
Occupancy Schedule Occ. Period	100%			
Occupancy Schedule Unocc. Period	95%			
Fresh Air Requirements or Outside Air	51	L/s.person	108	CFM/person

%OA 35.26%

Fresh Air Control Type *(enter a 1, 2 or 3) 1
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right: 15%
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation 0.5 L/s.m² 0.10 CFM/ft²
50% operation (%)

Sizing Factor	2			
Total Air Circulation or Design Air Flow	4.82	L/s.m²	0.95	CFM/ft²
Infiltration Rate	0.30	L/s.m²	0.06	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based	Total
Incidence of Use	0%		100%	100%
Switchover Point		KJ/kg.	18 °C	
		Btu/lbm	64.4 °F	

Summary of Design Parameters		
Peak Design Cooling Load	3,778,320	
Peak Zone Sensible Load	918,427	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	42,725	
Total air circulation or Design air	4.82	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	23	°C	73.4	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	22	°C	71.6	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	22	°C	71.6	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Nursing Home	50,000 to 100,000 ft²		Lower Mainland
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	267	Lux	24.8	ft-candles
Floor Fraction (GLFF)	0.70			
Connected Load	6.9	W/m²	0.6	W/ft²
Occ. Period(Hrs./yr.)	3400			
Unocc. Period(Hrs./yr.)	5360			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	20%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	200	300	500	1000				Total
% Distribution	33%	67%	0%	0%				100%
Weighted Average								**267**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)					100.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	1.9
	MJ/m².yr	75

ARCHITECTURAL LIGHTING

Light Level	233	Lux	21.7	ft-candles
Floor Fraction (ALFF)	0.30			
Connected Load	18.6	W/m²	1.7	W/ft²
Occ. Period(Hrs./yr.)	3400			
Unocc. Period(Hrs./yr.)	5360			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	30%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	200	300	400	500				Total
% Distribution	67%	33%	0%	0%				100%
Weighted Average								**233**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	35%	65%						100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	2.5
	MJ/m².yr	97

SPECIAL PURPOSE LIGHTING

Light Level	0.00	Lux	0.0	ft-candles
Floor Fraction (HBLFF)	0.00			
Connected Load	0.0	W/m²	0.0	W/ft²
Occ. Period(Hrs./yr.)	4000			
Unocc. Period(Hrs./yr.)	4760			
Usage During Occupied Period	0%			
Usage During Unoccupied Period	100%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 | 1.00

Light Level (Lux)	300	500	700	1000				Total
% Distribution		0%	0%	0%				0%
Weighted Average								**0**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)								0.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	0.0
	MJ/m².yr	0

TOTAL LIGHTING

Overall LPD	10.41 W/m²	EUI TOTAL	kWh/ft².yr	4.4
	0.97 W/ft²		MJ/m².yr	172

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Servers		Plug Loads	
Measured Power (W/device)	55		51		100		200		217			
Density (device/occupant)	0.477744		0.477744		0.02		0.02		0.04			
Connected Load	0.9	W/m²	0.8	W/m²	0.1	W/m²	0.1	W/m²	0.5	W/m²	1.35	W/m²
	0.1	W/ft²	0.1	W/ft²	0.01	W/ft²	0.01	W/ft²	0.05	W/ft²	0.13	W/ft²
Diversity Occupied Period	90%		90%		90%		90%		100%		90%	
Diversity Unoccupied Period	50%		50%		50%		50%		100%		25%	
Operation Occ. Period (hrs./year)	2000		2000		2600		2600		2600		4100	
Operation Unocc. Period (hrs./year)	6760		6760		6160		6160		6160		4660	

Total end-use load (occupied period)	3.4	W/m²	0.3	W/ft²
Total end-use load (unocc. period)	1.8	W/m²	0.2	W/ft²
Usage during occupied period	100%			
Usage during unoccupied period	52%			

	EUI		
Computer Equipment	EUI	kWh/ft².yr	1.33
		MJ/m².yr	51.37
Plug Loads	EUI	kWh/ft².yr	0.61
		MJ/m².yr	23.60

FOOD SERVICE EQUIPMENT

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	1.5	EUI	kWh/ft².yr	1.3
	MJ/m².yr	60.0		MJ/m².yr	50.0

REFRIGERATION

Provide description below:

Walk-in coolers/freezers, reach-in coolers/freezers, refrigerated buffet cases

EUI	kWh/ft².yr	0.8
	MJ/m².yr	30.0

MISCELLANEOUS

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	1.8	EUI	kWh/ft².yr	0.0
	MJ/m².yr	70.0		MJ/m².yr	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **Nursing Home** **Baseline** | **SIZE:** **50,000 to 100,000 ft²** | **VINTAGE:** | **REGION:** **Lower Mainland**

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	10%	40%	10%	15%	15%	0%	5%	0%	5%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff.) (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	20.1	W/m²	6.4	Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	329	MJ/m².yr	8.5	kWh/ft².yr
Sizing Factor	1.00			

Electric Fuel Share 10.0% Fossil Fuel Share 90.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	6.7
MJ/m².yr	261

Gas EUI	
kWh/ft².yr	10.7
MJ/m².yr	414

Market Composite EUI	
kWh/ft².yr	10.3
MJ/m².yr	398

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	0.0%	0.0%	0.0%	15.0%	85.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7	°C	44.6	°F
Condenser Water	30	°C	86	°F
Supply Air	14.0	°C	57.2	°F

Peak Cooling Load	112	W/m²	36	Btu/hr.ft²	336	ft²/Ton
Seasonal Cooling Load (Tertiary Load)	147.3	MJ/m².yr	3.8	kWh/ft².yr		

Sizing Factor 0.85 Operation (occ. period) 3000 hrs/year Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C) 30.0%

Electric Fuel Share 100.0% Gas Fuel Share 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenan

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	1.7
MJ/m².yr	66

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	1.7
MJ/m².yr	66

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	25%				45%
Eff./COP	0.65				0.75

	Fossil	Elec. Res.
Fuel Share	70%	30%
Blended Efficiency	0.71	0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 170.0

Wetting Use Percentage 90%

All Electric EUI	
kWh/ft².yr	4.8
MJ/m².yr	187

Fossil Fuel EUI	
kWh/ft².yr	6.1
MJ/m².yr	238

Market Composite EUI	
kWh/ft².yr	5.7
MJ/m².yr	222.6

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EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Nursing Home	**50,000 to 100,000 ft²**		**Lower Mainland**
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	4.8	L/s.m²	0.95	CFM/ft²
System Static Pressure CAV	500	Pa	2.0	wg
System Static Pressure VAV	500	Pa	2.0	wg
Fan Efficiency	52%			
Fan Motor Efficiency	75%			
Sizing Factor	1.00			
Fan Design Load CAV	6.2	W/m²	0.57	W/ft²
Fan Design Load VAV	6.2	W/m²	0.57	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	90%	10%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	80%	20%	100%	0%
Comments:				

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.0	L/s.m²	0.01	CFM/ft²
Other Exhaust (Smoking/Conference)	0.5	L/s.m²	0.10	CFM/ft²
Total Building Exhaust	0.5	L/s.m²	0.11	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.7	W/m²	0.07	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.020	kW/kW	0.07	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	2.25	W/m²	0.21	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.006	L/s.m²	0.009	U.S. gpm/ft²
Pump Head Pressure	0	kPa	0	ft
Pump Efficiency	55%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.00	W/m²	0.00	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.005	L/s.m²	0.0071	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	55%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.9	W/m²	0.08	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	46.3	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	6.4	kWh/m².yr
Condenser Pump Energy Consumption	0.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.8	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	4.4	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI	kWh/ft².yr	5.4
	MJ/m².yr	208.3

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Nursing Home	**50,000 to 100,000 ft²**		**Lower Mainland**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**17.3** kWh/ft².yr	**669.1** MJ/m².yr	**Fossil Fuel**	**17.3** kWh/ft².yr	**668.8** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	1.9	74.8
ARCHITECTURAL LIGHTING	2.5	97.2
SPECIAL PURPOSE LIGHTING	0.0	0.0
OTHER PLUG LOADS	0.6	23.6
HVAC FANS & PUMPS	5.4	208.3
REFRIGERATION	0.8	30.0
COMPUTER EQUIPMENT	1.3	51.4
ELEVATORS	0.3	11.6
OUTDOOR LIGHTING	0.5	20.4

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.7	26.1	9.6	372.2
SPACE COOLING	0.5	19.7	0.0	0.0
DOMESTIC HOT WATER	1.4	56.0	4.3	166.6
FOOD SERVICE EQUIPMENT	1.3	50.0	1.5	60.0
MISCELLANEOUS	0.0	0.0	1.8	70.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Schools	> 50,000 ft2		Lower Mainland
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.57	W/m².°C	0.10	Btu/hr.ft² . °F	Typical Building Size	9,300	m²	100,068	ft²
Roof U value (W/m².°C)	0.34	W/m².°C	0.06	Btu/hr.ft² . °F	Typical Footprint (m²)	4,650	m²	50,034	ft²
Glazing U value (W/m².°C)	4.57	W/m².°C	0.80	Btu/hr.ft² . °F	Footprint Aspect Ratio (L:W)	5			
					Percent Conditioned Space	100%			
					Percent Conditioned Space Defined as Exterior Zone	37%			
Window/Wall Ratio (WIWAR) (%)	0.15								
Shading Coefficient (SC)	0.45				Typical # Stories	2			
					Floor to Floor Height (m)	4.0	m	13.2	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	80%		0%		20%		0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	10	m²/person	108	ft²/person
Occupancy Schedule Occ. Period	90%			
Occupancy Schedule Unocc. Period	0%			
Fresh Air Requirements or Outside Air	15	L/s.person	32	CFM/person

%OA 36.08%

Fresh Air Control Type *(enter a 1, 2 or 3): 1
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right: 34%
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation: 0.5 L/s.m² | 0.10 CFM/ft² | 50% operation (%)

Sizing Factor	2			
Total Air Circulation or Design Air Flow	4.16	L/s.m²	0.82	CFM/ft²
Infiltration Rate	0.26	L/s.m²	0.05	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	3,829,956	
Peak Zone Sensible Load	880,548	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	40,963	
Total air circulation or Design air	4.16	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	23	°C	73.4	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	19.5	°C	67.1	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning — Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Schools	> 50,000 ft2		Lower Mainland
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	450	Lux	41.8	ft-candles
Floor Fraction (GLFF)	0.89			
Connected Load	11.6	W/m²	1.1	W/ft²
Occ. Period(Hrs./yr.)	2500			
Unocc. Period(Hrs./yr.)	6260			
Usage During Occupied Period	85%			
Usage During Unoccupied Period	10%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	300	500	700	1000	Total
% Distribution	25%	75%	0%	0%	100%
Weighted Average					**450**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)					100.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	2.6
	MJ/m².yr	102

ARCHITECTURAL LIGHTING

Light Level	300	Lux	27.9	ft-candles
Floor Fraction (ALFF)	0.01			
Connected Load	19.3	W/m²	1.8	W/ft²
Occ. Period(Hrs./yr.)	3000			
Unocc. Period(Hrs./yr.)	5760			
Usage During Occupied Period	90%			
Usage During Unoccupied Period	75%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	300	500	700	1000	Total
% Distribution	100%	0%	0%	0%	100%
Weighted Average					**300**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	20%	80%						100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	0.1
	MJ/m².yr	5

SPECIAL PURPOSE LIGHTING

Light Level	300.00	Lux	27.9	ft-candles
Floor Fraction (HBLFF)	0.10			
Connected Load	14.0	W/m²	1.3	W/ft²
Occ. Period(Hrs./yr.)	3000			
Unocc. Period(Hrs./yr.)	5760			
Usage During Occupied Period	100%			
Usage During Unoccupied Period	0%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 | 1.00

Light Level (Lux)	300	500	700	1000	Total
% Distribution	100%	0%	0%	0%	100%
Weighted Average					**300**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)						100%		100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	0.4
	MJ/m².yr	15

TOTAL LIGHTING

Overall LPD	11.94 W/m²	EUI TOTAL	kWh/ft².yr	3.2
	1.11 W/ft²		MJ/m².yr	122

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Servers	Plug Loads
Measured Power (W/device)	55	51	100	200	217	
Density (device/occupant)	0.222732	0.222732	0.02	0.02	0.01	
Connected Load	1.2 W/m²	1.1 W/m²	0.2 W/m²	0.4 W/m²	0.5 W/m²	0.1 W/m²
	0.1 W/ft²	0.1 W/ft²	0.02 W/ft²	0.04 W/ft²	0.05 W/ft²	0.01 W/ft²
Diversity Occupied Period	90%	90%	90%	90%	100%	100%
Diversity Unoccupied Period	25%	25%	25%	25%	100%	0%
Operation Occ. Period (hrs./year)	2000	2000	2000	2000	2600	3000
Operation Unocc. Period (hrs./year)	6760	6760	6760	6760	6160	5760

Total end-use load (occupied period)	3.3 W/m²	0.3 W/ft²
Total end-use load (unocc. period)	1.3 W/m²	0.1 W/ft²
Usage during occupied period	100%	
Usage during unoccupied period	38%	

Computer Equipment	EUI	kWh/ft².yr	1.37
		MJ/m².yr	53.21
Plug Loads	EUI	kWh/ft².yr	0.03
		MJ/m².yr	1.08

FOOD SERVICE EQUIPMENT

Provide description below:

Cafeteria

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	0.5	EUI	kWh/ft².yr	0.1
	MJ/m².yr	20.0		MJ/m².yr	2.1

REFRIGERATION

Provide description below:

Unknown

EUI	kWh/ft².yr	0.1
	MJ/m².yr	2.1

MISCELLANEOUS

Provide description below:

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	0.1	EUI	kWh/ft².yr	0.0
	MJ/m².yr	5.0		MJ/m².yr	1.0

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Large Schools	**> 50,000 ft2**		**Lower Mainland**
Baseline			

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	10%	60%	10%	5%	0%	0%	3%	10%	2%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff. (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	18.5 W/m²	5.9 Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	287 MJ/m².yr	7.4 kWh/ft².yr
Sizing Factor	1.00	
Electric Fuel Share	15.0%	Fossil Fuel Share 85.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	3.5
MJ/m².yr	136

Gas EUI	
kWh/ft².yr	9.2
MJ/m².yr	358

Market Composite EUI	
kWh/ft².yr	8.4
MJ/m².yr	325

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7 °C	44.6 °F
Condenser Water	30 °C	86 °F
Supply Air	14.0 °C	57.2 °F

Peak Cooling Load	121 W/m²	38 Btu/hr.ft²	314 ft²/Ton
Seasonal Cooling Load (Tertiary Load)	122.2 MJ/m².yr	3.2 kWh/ft².yr	

Sizing Factor 1.00 — Operation (occ. period) 3000 hrs/year — Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C) 20.0%

Electric Fuel Share 100.0% — Gas Fuel Share 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenan

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	1.3
MJ/m².yr	49

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	1.3
MJ/m².yr	49

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	65%				25%
Eff./COP	0.65				0.75

	Fossil		Elec. Res.
Fuel Share	90%		10%
Blended Efficiency	0.68		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 35.0

Wetting Use Percentage 90%

All Electric EUI	
kWh/ft².yr	1.0
MJ/m².yr	38

Fossil Fuel EUI	
kWh/ft².yr	1.3
MJ/m².yr	52

Market Composite EUI	
kWh/ft².yr	1.3
MJ/m².yr	50.3

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Schools	> 50,000 ft2		Lower Mainland
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	4.2	L/s.m²	0.82	CFM/ft²
System Static Pressure CAV	500	Pa	2.0	wg
System Static Pressure VAV	500	Pa	2.0	wg
Fan Efficiency	60%			
Fan Motor Efficiency	88%			
Sizing Factor	1.00			
Fan Design Load CAV	3.9	W/m²	0.37	W/ft²
Fan Design Load VAV	3.9	W/m²	0.37	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	80%	20%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	50%	50%	50%	50%
Comments:				

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.0	L/s.m²	0.01	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.1	L/s.m²	0.03	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.2	W/m²	0.02	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.027	kW/kW	0.09	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	3.26	W/m²	0.30	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.006	L/s.m²	0.009	U.S. gpm/ft²
Pump Head Pressure	45	kPa	15	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.72	W/m²	0.07	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 ℃ (10 ℉) delta T	0.005	L/s.m²	0.0077	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	1.0	W/m²	0.10	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	22.4	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	1.2	kWh/m².yr
Condenser Pump Energy Consumption	1.8	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.8	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	5.2	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI	kWh/ft².yr	2.9
	MJ/m².yr	113.1

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Schools	> 50,000 ft2		Lower Mainland
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	Electricity:	9.1 kWh/ft².yr	350.8 MJ/m².yr	Fossil Fuel	9.7 kWh/ft².yr	375.8 MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	2.6	102.5
ARCHITECTURAL LIGHTING	0.1	4.9
SPECIAL PURPOSE LIGHTING	0.4	15.1
OTHER PLUG LOADS	0.0	1.1
HVAC FANS & PUMPS	2.9	113.1
REFRIGERATION	0.1	2.1
COMPUTER EQUIPMENT	1.4	53.2
ELEVATORS	0.3	11.6
OUTDOOR LIGHTING	0.3	10.2

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.5	20.4	7.9	304.3
SPACE COOLING	0.3	9.8	0.0	0.0
DOMESTIC HOT WATER	0.1	3.8	1.2	46.5
FOOD SERVICE EQUIPMENT	0.1	2.1	0.5	20.0
MISCELLANEOUS	0.0	1.0	0.1	5.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Schools	< 50,000 ft2		Lower Mainland
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.57	W/m².°C	0.10	Btu/hr.ft² . °F
Roof U value (W/m².°C)	0.34	W/m².°C	0.06	Btu/hr.ft² . °F
Glazing U value (W/m².°C)	3.50	W/m².°C	0.62	Btu/hr.ft² . °F
Window/Wall Ratio (WIWAR) (%)	0.15			
Shading Coefficient (SC)	0.45			

Typical Building Size	2,300	m²	24,748	ft²
Typical Footprint (m²)	2,300	m²	24,748	ft²
Footprint Aspect Ratio (L:W)	5			
Percent Conditioned Space	100%			
Percent Conditioned Space Defined as Exterior Zone	50%			
Typical # Stories	1			
Floor to Floor Height (m)	4.0	m	13.2	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	90%		0%		10%		0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	10	m²/person	108	ft²/person
Occupancy Schedule Occ. Period	90%			
Occupancy Schedule Unocc. Period	0%			
Fresh Air Requirements or Outside Air	8	L/s.person	16	CFM/person

%OA 31.66%

Fresh Air Control Type *(enter a 1, 2 or 3) 1
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right: 34%
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation 0.5 L/s.m² 0.10 CFM/ft²
50% operation (%)

Sizing Factor	1.2			
Total Air Circulation or Design Air Flow	2.37	L/s.m²	0.47	CFM/ft²
Infiltration Rate	0.26	L/s.m²	0.05	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	597,882	
Peak Zone Sensible Load	206,778	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	9,619	
Total air circulation or Design air	2.37	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	21	°C	69.8	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	20.4	°C	68.72	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning   Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Schools	< 50,000 ft2		Lower Mainland
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	400	Lux	37.2	ft-candles
Floor Fraction (GLFF)	0.89			
Connected Load	10.3	W/m²	1.0	W/ft²
Occ. Period(Hrs./yr.)	2400			
Unocc. Period(Hrs./yr.)	6360			
Usage During Occupied Period	85%			
Usage During Unoccupied Period	25%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	300	500	700	1000				Total
% Distribution	50%	50%	0%	0%				100%
Weighted Average								**400**
	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			0.0%		100.0%			100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	3.1
	MJ/m².yr	120

ARCHITECTURAL LIGHTING

Light Level	400	Lux	37.2	ft-candles
Floor Fraction (ALFF)	0.01			
Connected Load	25.8	W/m²	2.4	W/ft²
Occ. Period(Hrs./yr.)	2400			
Unocc. Period(Hrs./yr.)	6360			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	30%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	300	500	700	1000				Total
% Distribution	50%	50%	0%	0%				100%
Weighted Average								**400**
	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	20%	80%						100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	0.1
	MJ/m².yr	4

SPECIAL PURPOSE LIGHTING

Light Level	300.00	Lux	27.9	ft-candles
Floor Fraction (HBLFF)	0.10			
Connected Load	14.0	W/m²	1.3	W/ft²
Occ. Period(Hrs./yr.)	2500			
Unocc. Period(Hrs./yr.)	6260			
Usage During Occupied Period	100%			
Usage During Unoccupied Period	0%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 | 1.00

Light Level (Lux)	300	500	700	1000				Total
% Distribution	100%	0%	0%	0%				100%
Weighted Average								**300**
	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)						100%		100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	0.3
	MJ/m².yr	13

TOTAL LIGHTING	Overall LPD	9.45 W/m²	EUI TOTAL kWh/ft².yr	3.5
		0.88 W/ft²	MJ/m².yr	137

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Servers		Plug Loads	
Measured Power (W/device)	55		51		100		200		217			
Density (device/occupant)	0.05		0.05		0.02		0.02		0.01			
Connected Load	0.3	W/m²	0.3	W/m²	0.2	W/m²	0.4	W/m²	0.5	W/m²	0.2	W/m²
	0.0	W/ft²	0.0	W/ft²	0.02	W/ft²	0.04	W/ft²	0.05	W/ft²	0.02	W/ft²
Diversity Occupied Period	90%		90%		90%		90%		100%		100%	
Diversity Unoccupied Period	25%		25%		25%		25%		100%		0%	
Operation Occ. Period (hrs./year)	2900		2900		2600		2600		2600		3000	
Operation Unocc. Period (hrs./year)	5860		5860		6160		6160		6160		5760	

Total end-use load (occupied period)	1.7	W/m²	0.2	W/ft²
Total end-use load (unocc. period)	0.8	W/m²	0.1	W/ft²
Usage during occupied period	100%			
Usage during unoccupied period	46%			

Computer Equipment	EUI	kWh/ft².yr	0.83
		MJ/m².yr	32.30
Plug Loads	EUI	kWh/ft².yr	0.06
		MJ/m².yr	2.16

FOOD SERVICE EQUIPMENT

Provide description below:

Cafeteria

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	0.1	EUI	kWh/ft².yr	0.1
	MJ/m².yr	5.0		MJ/m².yr	2.5

REFRIGERATION

Provide description below:

Unknown

EUI	kWh/ft².yr	0.1
	MJ/m².yr	3.0

MISCELLANEOUS

Provide description below:

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	0.1	EUI	kWh/ft².yr	0.1
	MJ/m².yr	5.0		MJ/m².yr	5.0

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Medium Schools	**< 50,000 ft2**		**Lower Mainland**
Baseline			

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	10%	60%	14%	5%	0%	0%	0%	10%	1%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff. (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	25.8 W/m²	8.2 Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	276 MJ/m².yr	7.1 kWh/ft².yr
Sizing Factor	1.00	
Electric Fuel Share	11.0%	Fossil Fuel Share 89.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	kWh/ft².yr	2.8
	MJ/m².yr	109
Gas EUI	kWh/ft².yr	8.9
	MJ/m².yr	343
Market Composite EUI	kWh/ft².yr	8.2
	MJ/m².yr	317

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7 °C	44.6 °F
Condenser Water	30 °C	86 °F
Supply Air	14.0 °C	57.2 °F

Peak Cooling Load	76 W/m²	24 Btu/hr.ft²	497 ft²/Ton
Seasonal Cooling Load (Tertiary Load)	101.1 MJ/m².yr	2.6 kWh/ft².yr	

Sizing Factor: 1.00 — Operation (occ. period): 3000 hrs/year — Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C): 10.0%

Electric Fuel Share: 100.0% — Gas Fuel Share: 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenan

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	kWh/ft².yr	1.1
	MJ/m².yr	42
Natural Gas EUI	kWh/ft².yr	0.0
	MJ/m².yr	0
Market Composite EUI	kWh/ft².yr	1.1
	MJ/m².yr	42

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	75%				10%
Eff./COP	0.65				0.75

	Fossil		Elec. Res.
Fuel Share	85%		15%
Blended Efficiency	0.66		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load): 35.0

Wetting Use Percentage: 90%

All Electric EUI		Fossil Fuel EUI		Market Composite EUI	
kWh/ft².yr	1.0	kWh/ft².yr	1.4	kWh/ft².yr	1.3
MJ/m².yr	38	MJ/m².yr	53	MJ/m².yr	50.7

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Medium Schools	**< 50,000 ft2**		**Lower Mainland**
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	2.4	L/s.m²	0.47	CFM/ft²
System Static Pressure CAV	250	Pa	1.0	wg
System Static Pressure VAV	250	Pa	1.0	wg
Fan Efficiency	60%			
Fan Motor Efficiency	88%			
Sizing Factor	1.00			
Fan Design Load CAV	1.1	W/m²	0.10	W/ft²
Fan Design Load VAV	1.1	W/m²	0.10	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	90%	10%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	50%	50%	50%	50%

Comments:

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m²	0.02	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.2	L/s.m²	0.04	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.2	W/m²	0.02	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.027	kW/kW	0.09	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	2.06	W/m²	0.19	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.004	L/s.m²	0.006	U.S. gpm/ft²
Pump Head Pressure	45	kPa	15	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.45	W/m²	0.04	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.003	L/s.m²	0.0048	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.7	W/m²	0.06	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	6.6	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	1.5	kWh/m².yr
Condenser Pump Energy Consumption	1.3	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.7	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	3.3	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI	kWh/ft².yr	1.2
	MJ/m².yr	48.4

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Medium Schools	**< 50,000 ft2**		**Lower Mainland**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**7.1** kWh/ft².yr	**273.7** MJ/m².yr	**Fossil Fue**	**9.3** kWh/ft².yr	**360.4** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	3.1	120.2
ARCHITECTURAL LIGHTING	0.1	3.9
SPECIAL PURPOSE LIGHTING	0.3	12.6
OTHER PLUG LOADS	0.1	2.2
HVAC FANS & PUMPS	1.2	48.4
REFRIGERATION	0.1	3.0
COMPUTER EQUIPMENT	0.8	32.3
ELEVATORS	0.3	11.6
OUTDOOR LIGHTING	0.3	10.2

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.3	12.0	7.9	305.4
SPACE COOLING	0.1	4.2	0.0	0.0
DOMESTIC HOT WATER	0.1	5.8	1.2	45.0
FOOD SERVICE EQUIPMENT	0.1	2.5	0.1	5.0
MISCELLANEOUS	0.1	5.0	0.1	5.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
University-Colleges	0		Lower Mainland
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.68	W/m².°C	0.12	Btu/hr.ft² . °F	Typical Building Size	9,000	m²	96,840	ft²
Roof U value (W/m².°C)	0.34	W/m².°C	0.06	Btu/hr.ft² . °F	Typical Footprint (m²)	3,000	m²	32,280	ft²
Glazing U value (W/m².°C)	3.50	W/m².°C	0.62	Btu/hr.ft² . °F	Footprint Aspect Ratio (L:W)	7			
					Percent Conditioned Space	100%			
					Percent Conditioned Space	50%			
Window/Wall Ratio (WIWAR) (%)	0.30				Defined as Exterior Zone				
Shading Coefficient (SC)	0.45				Typical # Stories	3			
					Floor to Floor Height (m)	3.7	m	12.0	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	50%		0%		50%		0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	14	m²/person	151	ft²/person
Occupancy Schedule Occ. Period	90%			
Occupancy Schedule Unocc. Period	0%			
Fresh Air Requirements or Outside Air	20	L/s.person	42	CFM/person

%OA 32.98%

Fresh Air Control Type *(enter a 1, 2 or 3)	1	If Fresh Air Control Type = "2" enter % FA. to the right:	34%			
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)		If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation	0.5	L/s.m²	0.10	CFM/ft²
			50%	operation (%)		

Sizing Factor	1.65			
Total Air Circulation or Design Air Flow	4.33	L/s.m²	0.85	CFM/ft²
Infiltration Rate	0.26	L/s.m²	0.05	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	3,745,176	
Peak Zone Sensible Load	1,076,006	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	50,056	
Total air circulation or Design air	4.33	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	24	°C	75.2	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	20.4	°C	68.72	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning — Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
University-Colleges	0		Lower Mainland
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	480	Lux	44.6	ft-candles
Floor Fraction (GLFF)	0.93			
Connected Load	12.4	W/m²	1.2	W/ft²

Occ. Period(Hrs./yr.)	4100	
Unocc. Period(Hrs./yr.)	4660	
Usage During Occupied Period	90%	
Usage During Unoccupied Period	20%	
Fixture Cleaning:		
Incidence of Practice		
Interval		years
Relamping Strategy & Incidence of Practice	Group	Spot

Light Level (Lux)	300	500	700	1000				Total
% Distribution	10%	90%	0%	0%				100%
Weighted Average								**480**
	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)					100.0%			100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	5.0
	MJ/m².yr	192

ARCHITECTURAL LIGHTING

Light Level	300	Lux	27.9	ft-candles
Floor Fraction (ALFF)	0.02			
Connected Load	20.9	W/m²	1.9	W/ft²

Occ. Period(Hrs./yr.)	4100	
Unocc. Period(Hrs./yr.)	4660	
Usage During Occupied Period	100%	
Usage During Unoccupied Period	100%	
Fixture Cleaning:		
Incidence of Practice		
Interval		years
Relamping Strategy & Incidence of Practice	Group	Spot

Light Level (Lux)	300	500	700	1000				Total
% Distribution	100%	0%	0%	0%				100%
Weighted Average								**300**
	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	25%	75%						100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	0.3
	MJ/m².yr	13

SPECIAL PURPOSE LIGHTING

Light Level	500.00	Lux	46.5	ft-candles
Floor Fraction (HBLFF)	0.05			
Connected Load	18.9	W/m²	1.8	W/ft²

Floor fraction check: should = 1.00 | 1.00

Occ. Period(Hrs./yr.)	4100	
Unocc. Period(Hrs./yr.)	4660	
Usage During Occupied Period	90%	
Usage During Unoccupied Period	20%	
Fixture Cleaning:		
Incidence of Practice		
Interval		years
Relamping Strategy & Incidence of Practice	Group	Spot

Light Level (Lux)	300	500	700	1000				Total
% Distribution	0%	100%	0%	0%				100%
Weighted Average								**500**
	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)						100%		100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.7	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	0.4
	MJ/m².yr	16

TOTAL LIGHTING	Overall LPD	11.95 W/m²	EUI TOTAL	kWh/ft².yr	5.7
		1.11 W/ft²		MJ/m².yr	221

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Servers		Plug Loads	
Measured Power (W/device)	55		51		100		200		217			
Density (device/occupant)	0.311825		0.311825		0.02		0.02		0.01			
Connected Load	1.2	W/m²	1.1	W/m²	0.1	W/m²	0.3	W/m²	0.5	W/m²	1.3	W/m²
	0.1	W/ft²	0.1	W/ft²	0.01	W/ft²	0.03	W/ft²	0.05	W/ft²	0.12	W/ft²
Diversity Occupied Period	90%		90%		90%		90%		100%		100%	
Diversity Unoccupied Period	50%		50%		50%		50%		100%		20%	
Operation Occ. Period (hrs./year)	2000		2000		2600		2600		2600		2000	
Operation Unocc. Period (hrs./year)	6760		6760		6160		6160		6160		6760	

Total end-use load (occupied period)	4.3	W/m²	0.4	W/ft²
Total end-use load (unocc. period)	2.2	W/m²	0.2	W/ft²
Usage during occupied period	100%			
Usage during unoccupied period	50%			

	EUI		
Computer Equipment	EUI	kWh/ft².yr	1.76
		MJ/m².yr	68.30
Plug Loads	EUI	kWh/ft².yr	0.40
		MJ/m².yr	15.69

FOOD SERVICE EQUIPMENT

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	0.8	EUI	kWh/ft².yr	0.3
	MJ/m².yr	30.0		MJ/m².yr	10.0

REFRIGERATION

Provide description below:

Unknown

EUI	kWh/ft².yr	0.5
	MJ/m².yr	20.0

MISCELLANEOUS

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	1.0	EUI	kWh/ft².yr	0.0
	MJ/m².yr	40.0		MJ/m².yr	0.0

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EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
University-Colleges	0		Lower Mainland
Baseline			

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	10%	49%	25%	10%	0%	0%	2%	1%	2%	0%	99%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff. (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	23.9	W/m²	7.6	Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	320	MJ/m².yr	8.3	kWh/ft².yr
Sizing Factor	1.00			
Electric Fuel Share	5.0%	Fossil Fuel Share	95.0%	

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	kWh/ft².yr	5.8
	MJ/m².yr	225
Gas EUI	kWh/ft².yr	10.2
	MJ/m².yr	394
Market Composite EUI	kWh/ft².yr	9.9
	MJ/m².yr	382

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	0.0%	25.0%	0.0%	0.0%	75.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7	°C	44.6	°F
Condenser Water	30	°C	86	°F
Supply Air	14.0	°C	57.2	°F

Peak Cooling Load	122	W/m²	39	Btu/hr.ft²	310	ft²/Ton
Seasonal Cooling Load (Tertiary Load)	151.4	MJ/m².yr	3.9	kWh/ft².yr		

Sizing Factor 1.00 — Operation (occ. period) 3000 hrs/year — Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C) 20.0%

Electric Fuel Share 100.0% — Gas Fuel Share 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenan

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	kWh/ft².yr	1.6
	MJ/m².yr	62
Natural Gas EUI	kWh/ft².yr	0.0
	MJ/m².yr	0
Market Composite EUI	kWh/ft².yr	1.6
	MJ/m².yr	62

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	10%				80%
Eff./COP	0.65				0.75

	Fossil		Elec. Res.
Fuel Share	90%		10%
Blended Efficiency	0.74		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 60.0

Wetting Use Percentage 90%

	All Electric EUI	Fossil Fuel EUI	Market Composite EUI
kWh/ft².yr	1.7	2.1	2.1
MJ/m².yr	66	81	79.7

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EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
University-Colleges	0		Lower Mainland
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	4.3	L/s.m²	0.85	CFM/ft²
System Static Pressure CAV	950	Pa	3.8	wg
System Static Pressure VAV	950	Pa	3.8	wg
Fan Efficiency	60%			
Fan Motor Efficiency	80%			
Sizing Factor	1.00			
Fan Design Load CAV	8.6	W/m²	0.80	W/ft²
Fan Design Load VAV	8.6	W/m²	0.80	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	50%	50%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	50%	50%	100%	0%

Comments:

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m²	0.01	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.2	L/s.m²	0.03	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.2	W/m²	0.02	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.027	kW/kW	0.09	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	3.29	W/m²	0.31	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.006	L/s.m²	0.010	U.S. gpm/ft²
Pump Head Pressure	0	kPa	0	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.00	W/m²	0.00	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.005	L/s.m²	0.0077	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	1.1	W/m²	0.10	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	43.3	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	1.9	kWh/m².yr
Condenser Pump Energy Consumption	0.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	1.0	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	5.3	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI		
	kWh/ft².yr	4.8
	MJ/m².yr	185.6

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
University-Colleges	0		Lower Mainland
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**15.0** kWh/ft².yr	**579.2** MJ/m².yr	**Fossil Fue** **13.4** kWh/ft².yr	**517.7** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	5.0	191.8
ARCHITECTURAL LIGHTING	0.3	13.2
SPECIAL PURPOSE LIGHTING	0.4	15.7
OTHER PLUG LOADS	0.4	15.7
HVAC FANS & PUMPS	4.8	185.6
REFRIGERATION	0.5	20.0
COMPUTER EQUIPMENT	1.8	68.3
ELEVATORS	0.3	11.6
OUTDOOR LIGHTING	0.4	17.0

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.3	11.2	9.7	374.6
SPACE COOLING	0.3	12.4	0.0	0.0
DOMESTIC HOT WATER	0.2	6.6	1.9	73.1
FOOD SERVICE EQUIPMENT	0.3	10.0	0.8	30.0
MISCELLANEOUS	0.0	0.0	1.0	40.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Restaurant	0		Lower Mainland
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.62	W/m².°C	0.11	Btu/hr.ft² . °F	Typical Building Size	781	m²	8,400	ft²
Roof U value (W/m².°C)	0.32	W/m².°C	0.06	Btu/hr.ft² . °F	Typical Footprint (m²)	781	m²	8,400	ft²
Glazing U value (W/m².°C)	3.50	W/m².°C	0.62	Btu/hr.ft² . °F	Footprint Aspect Ratio (L:W)	1			
					Percent Conditioned Space	100%			
					Percent Conditioned Space Defined as Exterior Zone	45%			
Window/Wall Ratio (WIWAR) (%)	0.18								
Shading Coefficient (SC)	0.69				Typical # Stories	1			
					Floor to Floor Height (m)	3.8	m	12.5	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	100%		0%		0%		0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	20 m²/person	215 ft²/person	%OA	32.24%
Occupancy Schedule Occ. Period	90%			
Occupancy Schedule Unocc. Period	0%			
Fresh Air Requirements or Outside Air	30 L/s.person	64 CFM/person		

Fresh Air Control Type *(enter a 1, 2 or 3) | 1 | If Fresh Air Control Type = "2" enter % FA. to the right: | 0%
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air) | If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation | 0.5 L/s.m² | 0.10 CFM/ft²
50% operation (%)

Sizing Factor	1.5	
Total Air Circulation or Design Air Flow	4.65 L/s.m²	0.92 CFM/ft²
Infiltration Rate	0.70 L/s.m²	0.14 CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0 L/s.m²	0.00 CFM/ft²
Operation occupied period	50%	
Operation unoccupied period	50%	

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	348,897	
Peak Zone Sensible Load	110,273	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R.	13.2	ft³/lbm
Design CFM	5,130	
Total air circulation or Design air	4.65	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional	PI / PID	Total
Control Mode			0%
	Fixed Discharge	Reset	
Control Strategy			0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	22	°C	71.6	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	21	°C	69.8	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning — Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Restaurant	0		Lower Mainland
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	400	Lux	37.1	ft-candles
Floor Fraction (GLFF)	0.30			
Connected Load	10.3	W/m²	1.0	W/ft²

Occ. Period(Hrs./yr.)	4100
Unocc. Period(Hrs./yr.)	4660
Usage During Occupied Period	95%
Usage During Unoccupied Period	30%

Light Level (Lux)	300	400	500	1000	Total
% Distribution	33%	33%	33%	0%	100%
Weighted Average					**399.6**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)					100.0%			100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

Fixture Cleaning:
Incidence of Practice
Interval years

Relamping Strategy & Incidence of Practice: Group | Spot

EUI	kWh/ft².yr	1.5
	MJ/m².yr	59

ARCHITECTURAL LIGHTING

Light Level	280	Lux	26.0	ft-candles
Floor Fraction (ALFF)	0.70			
Connected Load	29.5	W/m²	2.7	W/ft²

Occ. Period(Hrs./yr.)	4100
Unocc. Period(Hrs./yr.)	4660
Usage During Occupied Period	80%
Usage During Unoccupied Period	30%

Light Level (Lux)	100	200	300	400	Total
% Distribution	10%	30%	30%	30%	100%
Weighted Average					**280**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	60%	40%						100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

Fixture Cleaning:
Incidence of Practice
Interval years

Relamping Strategy & Incidence of Practice: Group | Spot

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	9.0
	MJ/m².yr	348

SPECIAL PURPOSE LIGHTING

Light Level	0.00	Lux	0.0	ft-candles
Floor Fraction (HBLFF)	0.00			
Connected Load	0.0	W/m²	0.0	W/ft²

Floor fraction check: should = 1.00 | 1.00

Occ. Period(Hrs./yr.)	4000
Unocc. Period(Hrs./yr.)	4760
Usage During Occupied Period	0%
Usage During Unoccupied Period	100%

Light Level (Lux)	300	500	700	1000	Total
% Distribution		0%	0%	0%	0%
Weighted Average					**0**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)								0.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

Fixture Cleaning:
Incidence of Practice
Interval years

Relamping Strategy & Incidence of Practice: Group | Spot

EUI	kWh/ft².yr	0.0
	MJ/m².yr	0

TOTAL LIGHTING

Overall LPD	23.77 W/m²	EUI TOTAL	kWh/ft².yr	10.5
	2.21 W/ft²		MJ/m².yr	407

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Servers	Plug Loads
Measured Power (W/device)	55	51	100	200	217	
Density (device/occupant)	0.1614	0.1614	0.01	0.01	0.01	
Connected Load	0.4 W/m²	0.4 W/m²	0.1 W/m²	0.1 W/m²	0.5 W/m²	3.2 W/m²
	0.0 W/ft²	0.0 W/ft²	0.00 W/ft²	0.01 W/ft²	0.05 W/ft²	0.30 W/ft²
Diversity Occupied Period	90%	90%	90%	90%	100%	90%
Diversity Unoccupied Period	50%	50%	50%	50%	100%	90%
Operation Occ. Period (hrs./year)	2000	2000	2600	2600	2600	4100
Operation Unocc. Period (hrs./year)	6760	6760	6160	6160	6160	4660

Total end-use load (occupied period)	4.3 W/m²	0.4 W/ft²
Total end-use load (unocc. period)	3.9 W/m²	0.4 W/ft²

Usage during occupied period	100%
Usage during unoccupied period	91%

Computer Equipment	EUI	kWh/ft².yr	0.90
		MJ/m².yr	34.97
Plug Loads	EUI	kWh/ft².yr	2.34
		MJ/m².yr	90.82

FOOD SERVICE EQUIPMENT

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	23.2	EUI	kWh/ft².yr	8.6
	MJ/m².yr	900.0		MJ/m².yr	333.0

REFRIGERATION

Provide description below:

EUI	kWh/ft².yr	16.8
	MJ/m².yr	650.0

MISCELLANEOUS

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	0.8	EUI	kWh/ft².yr	2.3
	MJ/m².yr	30.0		MJ/m².yr	90.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Restaurant	0		Lower Mainland
Baseline			

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	1%	2%	1%	59%	30%	0%	2%	0%	5%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff. (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	28.8	W/m²	9.1	Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	354	MJ/m².yr	9.1	kWh/ft².yr
Sizing Factor	1.00			

Electric Fuel Share 7.0% Fossil Fuel Share 93.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	8.1
MJ/m².yr	312

Gas EUI	
kWh/ft².yr	11.9
MJ/m².yr	461

Market Composite EUI	
kWh/ft².yr	11.6
MJ/m².yr	451

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	0.0%	0.0%	0.0%	10.0%	90.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7	°C	44.6	°F
Condenser Water	30	°C	86	°F
Supply Air	14.0	°C	57.2	°F

Peak Cooling Load	157	W/m²	50	Btu/hr.ft²	241	ft²/Ton
Seasonal Cooling Load (Tertiary Load)	199.9	MJ/m².yr	5.2	kWh/ft².yr		

Sizing Factor 1.20 Operation (occ. period) 3000 hrs/year Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C) 70.0%

Electric Fuel Share 100.0% Gas Fuel Share 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenan

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	2.3
MJ/m².yr	89

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	2.3
MJ/m².yr	89

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Avg. Tank				Boiler
System Present (%)	65%				10%
Eff./COP	0.65				0.75

	Fossil		Elec. Res.
Fuel Share	75%		25%
Blended Efficiency	0.66		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 600.0

Wetting Use Percentage 10%

All Electric EUI	
kWh/ft².yr	17.0
MJ/m².yr	659

Fossil Fuel EUI	
kWh/ft².yr	23.4
MJ/m².yr	905

Market Composite EUI	
kWh/ft².yr	21.8
MJ/m².yr	843.2

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Restaurant	**0**		**Lower Mainland**
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	4.7	L/s.m²	0.92	CFM/ft²
System Static Pressure CAV	500	Pa	2.0	wg
System Static Pressure VAV	500	Pa	2.0	wg
Fan Efficiency	60%			
Fan Motor Efficiency	80%			
Sizing Factor	1.00			
Fan Design Load CAV	4.8	W/m²	0.45	W/ft²
Fan Design Load VAV	4.8	W/m²	0.45	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	100%	0%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	80%	20%	100%	0%

Comments:

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.3	L/s.m²	0.05	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.4	L/s.m²	0.07	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.5	W/m²	0.04	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.020	kW/kW	0.07	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	3.14	W/m²	0.29	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.008	L/s.m²	0.012	U.S. gpm/ft²
Pump Head Pressure	0	kPa	0	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.00	W/m²	0.00	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.007	L/s.m²	0.0100	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	0	kPa	0	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.0	W/m²	0.00	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	37.4	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	4.2	kWh/m².yr
Condenser Pump Energy Consumption	0.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	1.1	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	0.0	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI		
	kWh/ft².yr	4.0
	MJ/m².yr	153.3

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Restaurant	**0**		**Lower Mainland**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**55.9** kWh/ft².yr	**2,166.1** MJ/m².yr	**Fossil Fue** **52.6** kWh/ft².yr	**2,037.1** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	1.5	59.0
ARCHITECTURAL LIGHTING	9.0	348.2
SPECIAL PURPOSE LIGHTING	0.0	0.0
OTHER PLUG LOADS	2.3	90.8
HVAC FANS & PUMPS	4.0	153.3
REFRIGERATION	16.8	650.0
COMPUTER EQUIPMENT	0.9	35.0
ELEVATORS	0.3	11.6
OUTDOOR LIGHTING	3.8	145.9

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.6	21.9	11.1	428.7
SPACE COOLING	1.6	62.6	0.0	0.0
DOMESTIC HOT WATER	4.3	164.8	17.5	678.4
FOOD SERVICE EQUIPMENT	8.6	333.0	23.2	900.0
MISCELLANEOUS	2.3	90.0	0.8	30.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Warehouse/Whsale	**0**		**Lower Mainland**
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.45 W/m².°C	0.08 Btu/hr.ft² . °F	Typical Building Size	3,200 m²	34,432 ft²
Roof U value (W/m².°C)	0.32 W/m².°C	0.06 Btu/hr.ft² . °F	Typical Footprint (m²)	3,200 m²	34,432 ft²
Glazing U value (W/m².°C)	3.50 W/m².°C	0.62 Btu/hr.ft² . °F	Footprint Aspect Ratio (L:W)	1	
			Percent Conditioned Space	100%	
			Percent Conditioned Space Defined as Exterior Zone	40%	
Window/Wall Ratio (WIWAR) (%)	0.05				
Shading Coefficient (SC)	0.80		Typical # Stories	1	
			Floor to Floor Height (m)	6.1 m	19.9 ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	100%		0%		0%		0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	100 m²/person	1076 ft²/person	%OA 28.14%
Occupancy Schedule Occ. Period	90%		
Occupancy Schedule Unocc. Period	0%		
Fresh Air Requirements or Outside Air	30 L/s.person	64 CFM/person	

Fresh Air Control Type *(enter a 1, 2 or 3): 1
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right: 0%
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation: 0.5 L/s.m² | 0.10 CFM/ft² | 50% operation (%)

Sizing Factor	1	
Total Air Circulation or Design Air Flow	1.07 L/s.m²	0.21 CFM/ft²
Infiltration Rate	0.38 L/s.m²	0.07 CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0 L/s.m²	0.00 CFM/ft²
Operation occupied period	50%	
Operation unoccupied period	50%	

Economizer

	Enthalpy Based		Dry-Bulb Based	Total
Incidence of Use	0%		100%	100%
Switchover Point		KJ/kg.	18 °C	
		Btu/lbm	64.4 °F	

Summary of Design Parameters	
Peak Design Cooling Load	351,010
Peak Zone Sensible Load	155,384
Room air enthalpy	28.2 Btu/lbm
Discharge air enthalpy	23.4 Btu/lbm
Specific volume of air at 55F & 100% R	13.2 ft³/lbm
Design CFM	7,228
Total air circulation or Design air	1.07 l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	22	°C	71.6	°F	13	°C	55.4	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	16	°C	60.8	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	20.25	°C	68.45	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning — Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Warehouse/Whsale	0		Lower Mainland
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	400	Lux	37.2	ft-candles
Floor Fraction (GLFF)	0.18			
Connected Load	10.3	W/m²	1.0	W/ft²
Occ. Period(Hrs./yr.)	3500			
Unocc. Period(Hrs./yr.)	5260			
Usage During Occupied Period	100%			
Usage During Unoccupied Period	25%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	300	500	700	1000	Total
% Distribution	50%	50%	0%	0%	100%
Weighted Average					**400**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			0.0%	0%	100.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI		
	kWh/ft².yr	0.8
	MJ/m².yr	32

ARCHITECTURAL LIGHTING

Light Level	300	Lux	27.9	ft-candles
Floor Fraction (ALFF)	0.01			
Connected Load	23.3	W/m²	2.2	W/ft²
Occ. Period(Hrs./yr.)	2500			
Unocc. Period(Hrs./yr.)	6260			
Usage During Occupied Period	100%			
Usage During Unoccupied Period	50%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	300	500	700	1000	Total
% Distribution	100%	0%	0%	0%	100%
Weighted Average					**300**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	33%	67%					0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI		
	kWh/ft².yr	0.1
	MJ/m².yr	5

EUI = Load X Hrs. X SF X GLFF

SPECIAL PURPOSE LIGHTING

Light Level	400.00	Lux	37.2	ft-candles
Floor Fraction (HBLFF)	0.81			
Connected Load	15.6	W/m²	1.5	W/ft²
Occ. Period(Hrs./yr.)	3500			
Unocc. Period(Hrs./yr.)	5260			
Usage During Occupied Period	100%			
Usage During Unoccupied Period	25%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 — 1.00

Light Level (Lux)	300	500	700	1000	Total
% Distribution	50%	50%	0%	0%	100%
Weighted Average					**400**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)						85%	15%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.7	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI		
	kWh/ft².yr	5.7
	MJ/m².yr	219

TOTAL LIGHTING

Overall LPD		EUI TOTAL		
14.73 W/m²			kWh/ft².yr	6.6
1.37 W/ft²			MJ/m².yr	256

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Servers		Plug Loads	
Measured Power (W/device)	55		51		100		200		217			
Density (device/occupant)	0.5918		0.5918		0.03		0.03		0.06			
Connected Load	0.3	W/m²	0.3	W/m²	0.0	W/m²	0.1	W/m²	0.5	W/m²	2.5	W/m²
	0.0	W/ft²	0.0	W/ft²	0.00	W/ft²	0.01	W/ft²	0.05	W/ft²	0.23	W/ft²
Diversity Occupied Period	90%		90%		90%		90%		100%		90%	
Diversity Unoccupied Period	50%		50%		50%		50%		100%		25%	
Operation Occ. Period (hrs./year)	2000		2000		2600		2600		2600		4100	
Operation Unocc. Period (hrs./year)	6760		6760		6160		6160		6160		4660	

Total end-use load (occupied period)	3.4	W/m²	0.3	W/ft²
Total end-use load (unocc. period)	1.5	W/m²	0.1	W/ft²
Usage during occupied period	100%			
Usage during unoccupied period	44%			

	EUI		
Computer Equipment	EUI	kWh/ft².yr	0.76
		MJ/m².yr	29.58
Plug Loads	EUI	kWh/ft².yr	1.13
		MJ/m².yr	43.70

FOOD SERVICE EQUIPMENT

Provide description below:

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	0.1	EUI	kWh/ft².yr	0.1
	MJ/m².yr	5.0		MJ/m².yr	5.0

REFRIGERATION

Provide description below:

Large refrigeration storage

EUI		
	kWh/ft².yr	1.3
	MJ/m².yr	50.0

MISCELLANEOUS

Provide description below:

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	0.3	EUI	kWh/ft².yr	0.5
	MJ/m².yr	10.0		MJ/m².yr	20.0

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: Warehouse/Whsale Baseline

SIZE: 0

VINTAGE:

REGION: Lower Mainland

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						Gas	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Radiant	
System Present (%)	2%	5%	1%	35%	7%	30%		2%	3%	15%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	75%	1.70	3.00	100%	75%	
Performance (1 / Eff. (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.33	0.59	0.33	1.00	1.33	

Peak Heating Load	23.8 W/m²	7.5 Btu/hr.ft²	
Seasonal Heating Load (Tertiary Load)	186 MJ/m².yr	4.8 kWh/ft².yr	
Sizing Factor	1.00		
Electric Fuel Share	5.0%	Fossil Fuel Share	95.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	3.5
MJ/m².yr	137

Gas EUI	
kWh/ft².yr	6.3
MJ/m².yr	245

Market Composite EUI	
kWh/ft².yr	6.2
MJ/m².yr	240

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	0.0%	0.0%	0.0%	10.0%	90.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7 °C	44.6 °F
Condenser Water	30 °C	86 °F
Supply Air	13.0 °C	55.4 °F

Peak Cooling Load	32 W/m²	10 Btu/hr.ft²	1177 ft²/Ton
Seasonal Cooling Load (Tertiary Load)	78.2 MJ/m².yr	2.0 kWh/ft².yr	

Sizing Factor: 1.00 — Operation (occ. period): 3000 hrs/year — Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C): 30.0%

Electric Fuel Share: 100.0% — Gas Fuel Share: 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	0.4
MJ/m².yr	16

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	0.4
MJ/m².yr	16

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	65%				5%
Eff./COP	0.65				0.75

	Fossil		Elec. Res.
Fuel Share	70%		30%
Blended Efficiency	0.66		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load): 22.5

Wetting Use Percentage: 90%

All Electric EUI	
kWh/ft².yr	0.6
MJ/m².yr	25

Fossil Fuel EUI	
kWh/ft².yr	0.9
MJ/m².yr	34

Market Composite EUI	
kWh/ft².yr	0.8
MJ/m².yr	31.4

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Warehouse/Whsale	**0**		**Lower Mainland**
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	1.1	L/s.m²	0.21	CFM/ft²
System Static Pressure CAV	425	Pa	1.7	wg
System Static Pressure VAV	425	Pa	1.7	wg
Fan Efficiency	60%			
Fan Motor Efficiency	80%			
Sizing Factor	1.00			
Fan Design Load CAV	0.9	W/m²	0.09	W/ft²
Fan Design Load VAV	0.9	W/m²	0.09	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	100%	0%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	0%	100%	100%	0%
Comments:				

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m²	0.01	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.2	L/s.m²	0.03	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.2	W/m²	0.02	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.020	kW/kW	0.07	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	0.64	W/m²	0.06	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.002	L/s.m²	0.003	U.S. gpm/ft²
Pump Head Pressure	0	kPa	0	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.00	W/m²	0.00	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.001	L/s.m²	0.0020	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	50	kPa	17	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.1	W/m²	0.01	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	3.3	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	1.9	kWh/m².yr
Condenser Pump Energy Consumption	0.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.2	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	0.6	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI	kWh/ft².yr	0.6
	MJ/m².yr	21.6

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Warehouse/Whsale	**0**		**Lower Mainland**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	12.2 kWh/ft².yr	473.5 MJ/m².yr	**Fossil Fuel**	7.0 kWh/ft².yr	272.0 MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	0.8	32.2
ARCHITECTURAL LIGHTING	0.1	4.7
SPECIAL PURPOSE LIGHTING	5.7	219.1
OTHER PLUG LOADS	1.1	43.7
HVAC FANS & PUMPS	0.6	21.6
REFRIGERATION	1.3	50.0
COMPUTER EQUIPMENT	0.8	29.6
ELEVATORS	0.3	11.6
OUTDOOR LIGHTING	0.4	17.0

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.2	6.8	6.0	233.1
SPACE COOLING	0.1	4.8	0.0	0.0
DOMESTIC HOT WATER	0.2	7.4	0.6	24.0
FOOD SERVICE EQUIPMENT	0.1	5.0	0.1	5.0
MISCELLANEOUS	0.5	20.0	0.3	10.0

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large High Rise	**> 9,300 m² (100,000 ft²)**		**Lower Mainland**
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.81	W/m².°C	0.14	Btu/hr.ft² . °F	Typical Building Size	21,365	m²	229,887	ft²
Roof U value (W/m².°C)	0.34	W/m².°C	0.06	Btu/hr.ft² . °F	Typical Footprint (m²)	1,125	m²	12,100	ft²
Glazing U value (W/m².°C)	3.50	W/m².°C	0.62	Btu/hr.ft² . °F	Footprint Aspect Ratio (L:W)	1			
					Percent Conditioned Space	100%			
					Percent Conditioned Space Defined as Exterior Zone	45%			
Window/Wall Ratio (WIWAR) (%)	0.25								
Shading Coefficient (SC)	0.65				Typical # Stories	19			
					Floor to Floor Height (m)	3.7	m	12.0	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	100%		0%		0%		0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	40	m²/person	430	ft²/person
Occupancy Schedule Occ. Period	25%			
Occupancy Schedule Unocc. Period	80%			
Fresh Air Requirements or Outside Air	10	L/s.person	21	CFM/person

%OA 100.00%

Fresh Air Control Type *(enter a 1, 2 or 3) 3
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right:	0%			
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation	0.25	L/s.m²	0.05	CFM/ft²
	75%	operation (%)		

Sizing Factor	1			
Total Air Circulation or Design Air Flow	0.25	L/s.m²	0.05	CFM/ft²
Infiltration Rate	0.05	L/s.m²	0.01	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)		L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	2,538,460	
Peak Zone Sensible Load	1,456,782	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	67,769	
Total air circulation or Design air	1.50	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	20	°C	68	°F	13	°C	55.4	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	20.4	°C	68.72	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning — Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large High Rise	> 9,300 m² (100,000 ft²)		Lower Mainland
Baseline			

LIGHTING

GENERAL (Linear Fluorescent) LIGHTING

Light Level	160	Lux	14.9	ft-candles
Floor Fraction (GLFF)	0.10			
Connected Load	4.1	W/m²	0.4	W/ft²
Occ. Period(Hrs./yr.)	3400			
Unocc. Period(Hrs./yr.)	5360			
Usage During Occupied Period	90%			
Usage During Unoccupied Period	90%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	50	100	200	300	Total
% Distribution	0%	60%	20%	20%	100%
Weighted Average					**160**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			0.0%	0%	100.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	0.3
	MJ/m².yr	12

ARCHITECTURAL (Incandescent & replacements) LIGHTING

Light Level	130	Lux	12.1	ft-candles
Floor Fraction (ALFF)	0.90			
Connected Load	9.7	W/m²	0.9	W/ft²
Occ. Period(Hrs./yr.)	2900			
Unocc. Period(Hrs./yr.)	5860			
Usage During Occupied Period	25%			
Usage During Unoccupied Period	20%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	50	200	300	500	Total
% Distribution	60%	20%	20%	0%	100%
Weighted Average					**130**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	30%	70%					0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	1.5
	MJ/m².yr	60

SPECIAL PURPOSE LIGHTING

Light Level	0.00	Lux	0.0	ft-candles
Floor Fraction (HBLFF)	0.00			
Connected Load	0.0	W/m²	0.0	W/ft²
Occ. Period(Hrs./yr.)	4000			
Unocc. Period(Hrs./yr.)	4760			
Usage During Occupied Period	0%			
Usage During Unoccupied Period	100%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 | 1.00

Light Level (Lux)	300	500	700	1000	Total
% Distribution		0%	0%	0%	0%
Weighted Average					**0**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)								0.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	0.0
	MJ/m².yr	0

TOTAL LIGHTING

Overall LPD	9.16 W/m²	EUI TOTAL	kWh/ft².yr	1.8
	0.85 W/ft²		MJ/m².yr	71

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Servers		Plug Loads	
Measured Power (W/device)	45		57		100		200		50			
Density (device/occupant)	0.8		0.8		0		0		0.00			
Connected Load	0.9	W/m²	1.1	W/m²	0.0	W/m²	0.0	W/m²	0.5	W/m²	1.8	W/m²
	0.1	W/ft²	0.1	W/ft²	0.00	W/ft²	0.00	W/ft²	0.05	W/ft²	0.17	W/ft²
Diversity Occupied Period	0%		0%		90%		90%		100%		40%	
Diversity Unoccupied Period	50%		50%		50%		10%		100%		85%	
Operation Occ. Period (hrs./year)	2900		2900		2600		2600		2600		3000	
Operation Unocc. Period (hrs./year)	5860		5860		6160		6160		6160		5760	

Total end-use load (occupied period)	1.2	W/m²	0.1	W/ft²
Total end-use load (unocc. period)	3.1	W/m²	0.3	W/ft²
Usage during occupied period	100%			
Usage during unoccupied period	249%			

Computer Equipment	EUI	kWh/ft².yr	0.98
		MJ/m².yr	37.77
Plug Loads	EUI	kWh/ft².yr	1.02
		MJ/m².yr	39.50

FOOD SERVICE EQUIPMENT

Provide description below:

Electric stoves (at 417 kWh/yr), etc.

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	0.3	EUI	kWh/ft².yr	0.7
	MJ/m².yr	10.0		MJ/m².yr	27.0

REFRIGERATION

Provide description below:

Residential refrigerators (560 kWh/yr) and freezers (370 kWh/yr)

EUI	kWh/ft².yr	0.7
	MJ/m².yr	26.0

MISCELLANEOUS

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	1.0	EUI	kWh/ft².yr	0.4
	MJ/m².yr	40.0		MJ/m².yr	15.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Large High Rise	**> 9,300 m² (100,000 ft²)**		**Lower Mainland**
Baseline			

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	5%	30%	10%	25%	15%	0%	3%	3%	9%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff. (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	17.9	W/m²	5.7	Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	216	MJ/m².yr	5.6	kWh/ft².yr
Sizing Factor	1.00			
Electric Fuel Share	15.0%	Fossil Fuel Share	85.0%	

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	4.4
MJ/m².yr	169

Gas EUI	
kWh/ft².yr	7.0
MJ/m².yr	273

Market Composite EUI	
kWh/ft².yr	6.6
MJ/m².yr	257

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	1.0%	0.0%		5.0%	94.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7	°C	44.6	°F
Condenser Water	30	°C	86	°F
Supply Air	13.0	°C	55.4	°F

Peak Cooling Load	5	W/m²	2	Btu/hr.ft²	7245	ft²/Ton
Seasonal Cooling Load (Tertiary Load)	69.4	MJ/m².yr	1.8	kWh/ft².yr		

Sizing Factor: 0.15 — Operation (occ. period): 3000 hrs/year — Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C): 15.0%

Electric Fuel Share: 100.0% — Gas Fuel Share: 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	0.5
MJ/m².yr	18

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	0.5
MJ/m².yr	18

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	25%				50%
Eff./COP	0.65				0.75

	Fossil		Elec. Res.
Fuel Share	75%		25%
Blended Efficiency	0.72		1.00

Service Hot Water load (MJ/m².yr) (Tertiary Load): 200.0

Wetting Use Percentage: 80%

All Electric EUI	
kWh/ft².yr	5.2
MJ/m².yr	200

Fossil Fuel EUI	
kWh/ft².yr	7.2
MJ/m².yr	279

Market Composite EUI	
kWh/ft².yr	6.7
MJ/m².yr	259.3

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large High Rise	> 9,300 m² (100,000 ft²)		Lower Mainland
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	0.3	L/s.m²	0.05	CFM/ft²
System Static Pressure CAV	625	Pa	2.5	wg
System Static Pressure VAV	0	Pa	0.0	wg
Fan Efficiency	52%			
Fan Motor Efficiency	90%			
Sizing Factor	1.00			
Fan Design Load CAV	0.3	W/m²	0.03	W/ft²
Fan Design Load VAV	0.0	W/m²	0.00	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	100%	0%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	75%	25%	75%	25%

Comments:

EXHAUST FANS

Washroom Exhaust	50	L/s.washroom	106	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m²	0.02	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.2	L/s.m²	0.04	CFM/ft²
Exhaust System Static Pressure	125	Pa	0.5	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.1	W/m²	0.01	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.000	kW/kW	0.00	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	0.00	W/m²	0.00	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.000	L/s.m²	0.000	U.S. gpm/ft²
Pump Head Pressure	0	kPa	0	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.00	W/m²	0.00	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.000	L/s.m²	0.0003	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.0	W/m²	0.00	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	2.5	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	0.9	kWh/m².yr
Condenser Pump Energy Consumption	0.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.0	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	0.2	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI		
	kWh/ft².yr	0.3
	MJ/m².yr	13.1

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **Large High Rise** **Baseline**

SIZE: **> 9,300 m² (100,000 ft²)**

VINTAGE:

REGION: **Lower Mainland**

EUI SUMMARY

TOTAL ALL END-USES: **Electricity:** **8.7** kWh/ft².yr **336.5** MJ/m².yr **Fossil Fue** **12.7** kWh/ft².yr **491.0** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL (Linear Fluorescent) LIGHT	0.3	11.7
ARCHITECTURAL (Incandescent & re	1.5	59.7
SPECIAL PURPOSE LIGHTING	0.0	0.0
OTHER PLUG LOADS	1.0	39.5
HVAC FANS & PUMPS	0.3	13.1
REFRIGERATION	0.7	26.0
COMPUTER EQUIPMENT	1.0	37.8
ELEVATORS	0.3	11.6
OUTDOOR LIGHTING	0.4	17.0

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.7	25.4	6.0	231.7
SPACE COOLING	0.1	2.7	0.0	0.0
DOMESTIC HOT WATER	1.3	50.0	5.4	209.3
FOOD SERVICE EQUIPMENT	0.7	27.0	0.3	10.0
MISCELLANEOUS	0.4	15.0	1.0	40.0

COMMERCIAL SECTOR BUILDING PROFILE

New BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Apartment			Lower Mainland
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.81 W/m².°C	0.14 Btu/hr.ft². °F	Typical Building Size	8,000 m² / 86,080 ft²
Roof U value (W/m².°C)	0.34 W/m².°C	0.06 Btu/hr.ft². °F	Typical Footprint (m²)	1,600 m² / 17,216 ft²
Glazing U value (W/m².°C)	3.50 W/m².°C	0.62 Btu/hr.ft². °F	Footprint Aspect Ratio (L:W)	3
			Percent Conditioned Space	100%
			Percent Conditioned Space Defined as Exterior Zone	45%
Window/Wall Ratio (WIWAR) (%)	0.25			
Shading Coefficient (SC)	0.65		Typical # Stories	5
			Floor to Floor Height (m)	3.7 m / 12.0 ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	100%		0%		0%		0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	40 m²/person	430 ft²/person	%OA 100.00%
Occupancy Schedule Occ. Period	25%		
Occupancy Schedule Unocc. Period	80%		
Fresh Air Requirements or Outside Air	10 L/s.person	21 CFM/person	

Fresh Air Control Type *(enter a 1, 2 or 3) — 3
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)
If Fresh Air Control Type = "2" enter % FA. to the right: 0%
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation: 0.25 L/s.m² — 0.05 CFM/ft² — 75% operation (%)

Sizing Factor	1	
Total Air Circulation or Design Air Flow	0.25 L/s.m²	0.05 CFM/ft²
Infiltration Rate	0.05 L/s.m²	0.01 CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	L/s.m²	0.00 CFM/ft²
Operation occupied period	50%	
Operation unoccupied period	50%	

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	876,637	
Peak Zone Sensible Load	471,619	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	21,940	
Total air circulation or Design air	1.29	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	23	°C	73.4	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	20.4	°C	68.72	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning — Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

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COMMERCIAL SECTOR BUILDING PROFILE

New BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Apartment			Lower Mainland
Baseline			

LIGHTING

GENERAL (Linear Fluorescent) LIGHTING

Light Level	160	Lux	14.9	ft-candles
Floor Fraction (GLFF)	0.10			
Connected Load	4.1	W/m²	0.4	W/ft²

Occ. Period(Hrs./yr.)	3400
Unocc. Period(Hrs./yr.)	5360
Usage During Occupied Period	90%
Usage During Unoccupied Period	90%

Light Level (Lux)	50	100	200	300				Total
% Distribution	0%	60%	20%	20%				100%
Weighted Average								**160**
	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			0.0%	0%	100.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

Fixture Cleaning:
Incidence of Practice
Interval years

Relamping Strategy & Incidence of Practice: Group | Spot

EUI	kWh/ft².yr	0.3
	MJ/m².yr	12

ARCHITECTURAL (Incandescent & replacements) LIGHTING

Light Level	130	Lux	12.1	ft-candles
Floor Fraction (ALFF)	0.90			
Connected Load	9.7	W/m²	0.9	W/ft²

Occ. Period(Hrs./yr.)	2900
Unocc. Period(Hrs./yr.)	5860
Usage During Occupied Period	25%
Usage During Unoccupied Period	20%

Light Level (Lux)	50	200	300	500				Total
% Distribution	60%	20%	20%	0%				100%
Weighted Average								**130**
	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	30%	70%					0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

Fixture Cleaning:
Incidence of Practice
Interval years

Relamping Strategy & Incidence of Practice: Group | Spot

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	1.5
	MJ/m².yr	60

SPECIAL PURPOSE LIGHTING

Light Level	0.00	Lux	0.0	ft-candles
Floor Fraction (HBLFF)	0.00			
Connected Load	0.0	W/m²	0.0	W/ft²

Floor fraction check: should = 1.00 | 1.00

Occ. Period(Hrs./yr.)	4000
Unocc. Period(Hrs./yr.)	4760
Usage During Occupied Period	0%
Usage During Unoccupied Period	100%

Light Level (Lux)	300	500	700	1000				Total
% Distribution		0%	0%	0%				0%
Weighted Average								**0**
	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)								0.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

Fixture Cleaning:
Incidence of Practice
Interval years

Relamping Strategy & Incidence of Practice: Group | Spot

EUI	kWh/ft².yr	0.0
	MJ/m².yr	0

TOTAL LIGHTING

Overall LPD	9.16 W/m²	EUI TOTAL	kWh/ft².yr	1.8
	0.85 W/ft²		MJ/m².yr	71

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Servers		Plug Loads	
Measured Power (W/device)	45		57		100		200		50			
Density (device/occupant)	0.8		0.8		0		0		0.00			
Connected Load	0.9	W/m²	1.1	W/m²	0.0	W/m²	0.0	W/m²	0.5	W/m²	1.8	W/m²
	0.1	W/ft²	0.1	W/ft²	0.00	W/ft²	0.00	W/ft²	0.05	W/ft²	0.17	W/ft²
Diversity Occupied Period	0%		0%		90%		90%		100%		40%	
Diversity Unoccupied Period	50%		50%		50%		10%		100%		85%	
Operation Occ. Period (hrs./year)	2900		2900		2600		2600		2600		3000	
Operation Unocc. Period (hrs./year)	5860		5860		6160		6160		6160		5760	

Total end-use load (occupied period)	1.2	W/m²	0.1	W/ft²
Total end-use load (unocc. period)	3.1	W/m²	0.3	W/ft²

Usage during occupied period	100%
Usage during unoccupied period	249%

Computer Equipment	EUI	kWh/ft².yr	0.98
		MJ/m².yr	37.77
Plug Loads	EUI	kWh/ft².yr	1.02
		MJ/m².yr	39.50

FOOD SERVICE EQUIPMENT

Provide description below:
Electric stoves (at 417 kWh/yr), etc.

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	0.1	EUI	kWh/ft².yr	0.7
	MJ/m².yr	5.0		MJ/m².yr	27.0

REFRIGERATION

Provide description below:
Residential refrigerators (560 kWh/yr) and freezers (370 kWh/yr)

EUI	kWh/ft².yr	0.7
	MJ/m².yr	26.0

MISCELLANEOUS

Provide description below:

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	0.8	EUI	kWh/ft².yr	0.0
	MJ/m².yr	30.0		MJ/m².yr	

COMMERCIAL SECTOR BUILDING PROFILE

New BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Apartment			Lower Mainland
Baseline			

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	5%	30%	10%	20%	15%	0%	3%	3%	14%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff. (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	18.7	W/m²	5.9	Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	235	MJ/m².yr	6.1	kWh/ft².yr
Sizing Factor	1.00			
Electric Fuel Share	20.0%	Fossil Fuel Share	80.0%	

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	5.1
MJ/m².yr	197

Gas EUI	
kWh/ft².yr	7.6
MJ/m².yr	296

Market Composite EUI	
kWh/ft².yr	7.1
MJ/m².yr	276

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	1.0%	0.0%		5.0%	94.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7	°C	44.6	°F
Condenser Water	30	°C	86	°F
Supply Air	14.0	°C	57.2	°F

Peak Cooling Load	5	W/m²	2	Btu/hr.ft²	7855	ft²/Ton
Seasonal Cooling Load (Tertiary Load)	61.9	MJ/m².yr	1.6	kWh/ft².yr		

Sizing Factor 0.15 — Operation (occ. period) 3000 hrs/year Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C) 15.0%

Electric Fuel Share 100.0% — Gas Fuel Share 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	0.4
MJ/m².yr	16

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	0.4
MJ/m².yr	16

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	60%				20%
Eff./COP	0.65				0.75

	Fossil		Elec. Res.
Fuel Share	80%		20%
Blended Efficiency	0.68		1.00

Service Hot Water load (MJ/m².yr) (Tertiary Load) 180.0

Wetting Use Percentage 80%

All Electric EUI	
kWh/ft².yr	4.6
MJ/m².yr	180

Fossil Fuel EUI	
kWh/ft².yr	6.9
MJ/m².yr	267

Market Composite EUI	
kWh/ft².yr	6.4
MJ/m².yr	249.3

New BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Apartment			Lower Mainland
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	0.3	L/s.m²	0.05	CFM/ft²
System Static Pressure CAV	625	Pa	2.5	wg
System Static Pressure VAV	0	Pa	0.0	wg
Fan Efficiency	52%			
Fan Motor Efficiency	90%			
Sizing Factor	1.00			
Fan Design Load CAV	0.3	W/m²	0.03	W/ft²
Fan Design Load VAV	0.0	W/m²	0.00	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	100%	0%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	75%	25%	75%	25%

Comments:

EXHAUST FANS

Washroom Exhaust	50	L/s.washroom	106	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m²	0.01	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.2	L/s.m²	0.03	CFM/ft²
Exhaust System Static Pressure	125	Pa	0.5	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.1	W/m²	0.01	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.000	kW/kW	0.00	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	0.00	W/m²	0.00	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.000	L/s.m²	0.000	U.S. gpm/ft²
Pump Head Pressure	0	kPa	0	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.00	W/m²	0.00	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.000	L/s.m²	0.0003	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.0	W/m²	0.00	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	2.5	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	0.8	kWh/m².yr
Condenser Pump Energy Consumption	0.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.0	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	0.2	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI		
	kWh/ft².yr	0.3
	MJ/m².yr	12.6

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85

COMMERCIAL SECTOR BUILDING PROFILE

New BUILDINGS: **SIZE:** **VINTAGE:** **REGION:**
Medium Apartment **Lower Mainland**
Baseline

EUI SUMMARY

TOTAL ALL END-USES: **Electricity:** **8.3** kWh/ft².yr **320.7** MJ/m².yr **Fossil Fue** **12.5** kWh/ft².yr **485.3** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL (Linear Fluorescent) LIGHT	0.3	11.7
ARCHITECTURAL (Incandescent & re	1.5	59.7
SPECIAL PURPOSE LIGHTING	0.0	0.0
OTHER PLUG LOADS	1.0	39.5
HVAC FANS & PUMPS	0.3	12.6
REFRIGERATION	0.7	26.0
COMPUTER EQUIPMENT	1.0	37.8
ELEVATORS	0.3	11.6
OUTDOOR LIGHTING	0.4	17.0

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	1.0	39.5	6.1	237.0
SPACE COOLING	0.1	2.4	0.0	0.0
DOMESTIC HOT WATER	0.9	36.0	5.5	213.3
FOOD SERVICE EQUIPMENT	0.7	27.0	0.1	5.0
MISCELLANEOUS	0.0	0.0	0.8	30.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Office	> 9,300 m² (100,000 ft²)		Vancouver Island
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.88	W/m².°C	0.15	Btu/hr.ft² . °F	Typical Building Size	21,365	m²	229,887	ft²
Roof U value (W/m².°C)	0.34	W/m².°C	0.06	Btu/hr.ft² . °F	Typical Footprint (m²)	1,526	m²	16,421	ft²
Glazing U value (W/m².°C)	3.50	W/m².°C	0.62	Btu/hr.ft² . °F	Footprint Aspect Ratio (L:W)	1			
					Percent Conditioned Space	100%			
					Percent Conditioned Space Defined as Exterior Zone	45%			
Window/Wall Ratio (WIWAR) (%)	0.60								
Shading Coefficient (SC)	0.40				Typical # Stories	14			
					Floor to Floor Height (m)	3.7	m	12.0	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	50%		0%		50%		0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	26	m²/person	274	ft²/person
Occupancy Schedule Occ. Period	90%			
Occupancy Schedule Unocc. Period	0%			
Fresh Air Requirements or Outside Air	20	L/s.person	42	CFM/person

%OA 16.74%

Fresh Air Control Type *(enter a 1, 2 or 3) 1
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right: 34%
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation 0.5 L/s.m² 0.10 CFM/ft²
50% operation (%)

Sizing Factor	1.7			
Total Air Circulation or Design Air Flow	4.68	L/s.m²	0.92	CFM/ft²
Infiltration Rate	0.19	L/s.m²	0.04	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	6,160,533	
Peak Zone Sensible Load	2,681,773	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	124,756	
Total air circulation or Design air	4.68	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	24	°C	75.2	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	20.4	°C	68.72	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Office	> 9,300 m² (100,000 ft²)		Vancouver Island
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	440	Lux	40.9	ft-candles
Floor Fraction (GLFF)	0.95			
Connected Load	11.4	W/m²	1.1	W/ft²
Occ. Period(Hrs./yr.)	2900			
Unocc. Period(Hrs./yr.)	5860			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	25%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	300	500	700	1000				Total
% Distribution	30%	70%	0%	0%				100%
Weighted Average								**440**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)					100.0%			100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	4.2
	MJ/m².yr	164

ARCHITECTURAL LIGHTING

Light Level	300	Lux	27.9	ft-candles
Floor Fraction (ALFF)	0.05			
Connected Load	20.9	W/m²	1.9	W/ft²
Occ. Period(Hrs./yr.)	3400			
Unocc. Period(Hrs./yr.)	5360			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	50%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	300	500	700	1000				Total
% Distribution	100%	0%	0%	0%				100%
Weighted Average								**300**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	25%	75%					0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	0.6
	MJ/m².yr	22

SPECIAL PURPOSE LIGHTING

Light Level	0.00	Lux	0.0	ft-candles
Floor Fraction (HBLFF)	0.00			
Connected Load	0.0	W/m²	0.0	W/ft²
Occ. Period(Hrs./yr.)	4000			
Unocc. Period(Hrs./yr.)	4760			
Usage During Occupied Period	0%			
Usage During Unoccupied Period	100%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 | 1.00

Light Level (Lux)	300	500	700	1000				Total
% Distribution		0%	0%	0%				0%
Weighted Average								**0**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)								0.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	0.0
	MJ/m².yr	0

TOTAL LIGHTING

Overall LPD	11.84 W/m²	EUI TOTAL	kWh/ft².yr	4.8
	1.10 W/ft²		MJ/m².yr	186

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Servers	Plug Loads
Measured Power (W/device)	55	51	100	200	217	
Density (device/occupant)	0.9	0.9	0.15	0.1	0.06	
Connected Load	1.9 W/m²	1.8 W/m²	0.6 W/m²	0.8 W/m²	0.5 W/m²	2.5 W/m²
	0.2 W/ft²	0.2 W/ft²	0.05 W/ft²	0.07 W/ft²	0.05 W/ft²	0.23 W/ft²
Diversity Occupied Period	90%	90%	90%	90%	100%	90%
Diversity Unoccupied Period	50%	50%	50%	50%	100%	25%
Operation Occ. Period (hrs./year)	2500	2500	2500	2500	2500	3000
Operation Unocc. Period (hrs./year)	6260	6260	6260	6260	6260	5760

Total end-use load (occupied period)	7.3 W/m²	0.7 W/ft²
Total end-use load (unocc. period)	3.7 W/m²	0.3 W/ft²
Usage during occupied period	100%	
Usage during unoccupied period	50%	

Computer Equipment	EUI	kWh/ft².yr	2.96
		MJ/m².yr	114.76
Plug Loads	EUI	kWh/ft².yr	0.96
		MJ/m².yr	37.26

FOOD SERVICE EQUIPMENT

Provide description below:

Cafeteria

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	0.3	EUI	kWh/ft².yr	0.1
	MJ/m².yr	10.0		MJ/m².yr	3.0

REFRIGERATION

Provide description below:

Unknown

EUI	kWh/ft².yr	0.1
	MJ/m².yr	4.0

MISCELLANEOUS

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	0.3	EUI	kWh/ft².yr	0.0
	MJ/m².yr	10.0		MJ/m².yr	0.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Large Office	**> 9,300 m² (100,000 ft²)**		**Vancouver Island**
Baseline			

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	35%	35%	15%	10%	0%	0%	1%	1%	3%	0%	100%
Seasonal Eff./COP	75%	80%	90%	77%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff. (kW/kW)	1.33	1.25	1.11	1.30	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	26.1 W/m²	8.3 Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	239 MJ/m².yr	6.2 kWh/ft².yr
Sizing Factor	1.00	
Electric Fuel Share	5.0%	Fossil Fuel Share 95.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	4.8
MJ/m².yr	188

Gas EUI	
kWh/ft².yr	7.8
MJ/m².yr	303

Market Composite EUI	
kWh/ft².yr	7.7
MJ/m².yr	297

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	0.0%	70.0%	20.0%	5.0%	5.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7 °C	44.6 °F
Condenser Water	30 °C	86 °F
Supply Air	14.0 °C	57.2 °F

Peak Cooling Load	84 W/m²	27 Btu/hr.ft²	448 ft²/Ton
Seasonal Cooling Load (Tertiary Load)	122.0 MJ/m².yr	3.1 kWh/ft².yr	

Sizing Factor 1.00 — Operation (occ. period) 3000 hrs/year Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C) 90.0%

Electric Fuel Share 100.0% — Gas Fuel Share 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenan

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	1.3
MJ/m².yr	51

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	1.3
MJ/m².yr	51

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	40%				30%
Eff./COP	0.65				0.80

	Fossil		Elec. Res.
Fuel Share	70%		30%
Blended Efficiency	0.71		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 35.0

Wetting Use Percentage 90%

All Electric EUI	
kWh/ft².yr	1.0
MJ/m².yr	38

Fossil Fuel EUI	
kWh/ft².yr	1.3
MJ/m².yr	49

Market Composite EUI	
kWh/ft².yr	1.2
MJ/m².yr	45.8

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Large Office	**> 9,300 m² (100,000 ft²)**		**Vancouver Island**
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	4.7	L/s.m²	0.92	CFM/ft²
System Static Pressure CAV	900	Pa	3.6	wg
System Static Pressure VAV	900	Pa	3.6	wg
Fan Efficiency	52%			
Fan Motor Efficiency	85%			
Sizing Factor	1.00			
Fan Design Load CAV	9.5	W/m²	0.89	W/ft²
Fan Design Load VAV	9.5	W/m²	0.89	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	50%	50%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	50%	50%	100%	0%

Comments:

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m²	0.03	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.2	L/s.m²	0.05	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	80%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.3	W/m²	0.03	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.020	kW/kW	0.07	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	1.69	W/m²	0.16	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.004	L/s.m²	0.007	U.S. gpm/ft²
Pump Head Pressure	90	kPa	30	ft
Pump Efficiency	55%			
Pump Motor Efficiency	85%			
Sizing Factor	1.0			
Pump Connected Load	0.86	W/m²	0.08	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.004	L/s.m²	0.0054	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	150	kPa	50	ft		
Pump Efficiency	55%					
Pump Motor Efficiency	85%					
Sizing Factor	0.8					
Pump Connected Load	0.9	W/m²	0.09	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	47.8	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	2.5	kWh/m².yr
Condenser Pump Energy Consumption	1.6	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.7	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	4.7	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI	kWh/ft².yr	5.3
	MJ/m².yr	206.2

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Large Office	**> 9,300 m² (100,000 ft²)**		**Vancouver Island**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**16.7**	kWh/ft².yr	**647.0**	MJ/m².yr	**Fossil Fue**	**8.8** kWh/ft².yr	**341.8** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	4.2	164.0
ARCHITECTURAL LIGHTING	0.6	22.2
SPECIAL PURPOSE LIGHTING	0.0	0.0
OTHER PLUG LOADS	1.0	37.3
HVAC FANS & PUMPS	5.3	206.2
REFRIGERATION	0.1	4.0
COMPUTER EQUIPMENT	3.0	114.8
ELEVATORS	0.3	11.6
OUTDOOR LIGHTING	0.4	17.0

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.2	9.4	7.4	287.5
SPACE COOLING	1.2	46.0	0.0	0.0
DOMESTIC HOT WATER	0.3	11.5	0.9	34.3
FOOD SERVICE EQUIPMENT	0.1	3.0	0.3	10.0
MISCELLANEOUS	0.0	0.0	0.3	10.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Medium Office	**50,000 to 100,000 ft²**		**Vancouver Island**
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.89	W/m².°C	0.16	Btu/hr.ft² . °F	Typical Building Size	6,777	m²	72,921	ft²
Roof U value (W/m².°C)	0.34	W/m².°C	0.06	Btu/hr.ft² . °F	Typical Footprint (m²)	753	m²	8,102	ft²
Glazing U value (W/m².°C)	3.50	W/m².°C	0.62	Btu/hr.ft² . °F	Footprint Aspect Ratio (L:W)	1			
					Percent Conditioned Space	100%			
					Percent Conditioned Space Defined as Exterior Zone	45%			
Window/Wall Ratio (WIWAR) (%)	0.45								
Shading Coefficient (SC)	0.45				Typical # Stories	9			
					Floor to Floor Height (m)	3.7	m	12.0	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	50%		0%		50%		0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	26	m²/person	274	ft²/person	%OA	16.17%
Occupancy Schedule Occ. Period	90%					
Occupancy Schedule Unocc. Period	0%					
Fresh Air Requirements or Outside Air	20	L/s.person	42	CFM/person		

Fresh Air Control Type *(enter a 1, 2 or 3) | 1 | If Fresh Air Control Type = "2" enter % FA. to the right: | 34%

(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air) | If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation | 0.5 L/s.m² | 0.10 CFM/ft²

50% operation (%)

Sizing Factor	1.6			
Total Air Circulation or Design Air Flow	4.85	L/s.m²	0.95	CFM/ft²
Infiltration Rate	0.19	L/s.m²	0.04	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	2,038,911	
Peak Zone Sensible Load	935,445	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	43,517	
Total air circulation or Design air	4.85	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	22	°C	71.6	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	20.4	°C	68.72	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning — Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Office	50,000 to 100,000 ft²		Vancouver Island
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	460	Lux	42.8	ft-candles
Floor Fraction (GLFF)	0.98			
Connected Load	11.9	W/m²	1.1	W/ft²
Occ. Period(Hrs./yr.)	2900			
Unocc. Period(Hrs./yr.)	5860			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	25%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	300	500	700	1000				Total
% Distribution	20%	80%	0%	0%				100%
Weighted Average								**460**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			0.0%		100.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	4.6
	MJ/m².yr	177

ARCHITECTURAL LIGHTING

Light Level	300	Lux	27.9	ft-candles
Floor Fraction (ALFF)	0.02			
Connected Load	20.9	W/m²	1.9	W/ft²
Occ. Period(Hrs./yr.)	3400			
Unocc. Period(Hrs./yr.)	5360			
Usage During Occupied Period	100%			
Usage During Unoccupied Period	90%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	300	500	700	1000				Total
% Distribution	100%	0%	0%	0%				100%
Weighted Average								**300**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	25%	75%					0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	0.3
	MJ/m².yr	12

SPECIAL PURPOSE LIGHTING

Light Level	0.00	Lux	0.0	ft-candles
Floor Fraction (HBLFF)	0.00			
Connected Load	0.0	W/m²	0.0	W/ft²
Occ. Period(Hrs./yr.)	3400			
Unocc. Period(Hrs./yr.)	5360			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	40%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 | 1.00

Light Level (Lux)	300	500	700	1000				Total
% Distribution		0%	0%	0%				0%
Weighted Average								**0**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)								0.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	0.0
	MJ/m².yr	0

TOTAL LIGHTING

Overall LPD	12.06 W/m²	EUI TOTAL	kWh/ft².yr	4.9
	1.12 W/ft²		MJ/m².yr	189

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Servers	Plug Loads
Measured Power (W/device)	55	51	100	200	217	
Density (device/occupant)	0.9	0.9	0.15	0.1	0.06	
Connected Load	1.9 W/m²	1.8 W/m²	0.6 W/m²	0.8 W/m²	0.5 W/m²	1 W/m²
	0.2 W/ft²	0.2 W/ft²	0.05 W/ft²	0.07 W/ft²	0.05 W/ft²	0.09 W/ft²
Diversity Occupied Period	90%	90%	90%	90%	100%	80%
Diversity Unoccupied Period	50%	50%	50%	50%	100%	25%
Operation Occ. Period (hrs./year)	2500	2500	2500	2500	2500	2500
Operation Unocc. Period (hrs./year)	6260	6260	6260	6260	6260	6260

Total end-use load (occupied period)	5.9 W/m²	0.5 W/ft²
Total end-use load (unocc. period)	3.3 W/m²	0.3 W/ft²
Usage during occupied period	100%	
Usage during unoccupied period	56%	

Computer Equipment	EUI	kWh/ft².yr	2.96
		MJ/m².yr	114.76
Plug Loads	EUI	kWh/ft².yr	0.33
		MJ/m².yr	12.83

FOOD SERVICE EQUIPMENT

Provide description below:

Lunch room/cafeteria/restaurant

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	0.3	EUI	kWh/ft².yr	0.1
	MJ/m².yr	10.0		MJ/m².yr	3.0

REFRIGERATION

Provide description below:

Lunch room/cafeteria/restaurant

EUI	kWh/ft².yr	0.1
	MJ/m².yr	4.0

MISCELLANEOUS

Provide description below:

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	0.5	EUI	kWh/ft².yr	0.0
	MJ/m².yr	20.0		MJ/m².yr	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Medium Office	**50,000 to 100,000 ft²**		**Vancouver Island**
Baseline			

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	5%	35%	10%	45%	0%	0%	2%	1%	2%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff. (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	31.6	W/m²	10.0	Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	298	MJ/m².yr	7.7	kWh/ft².yr
Sizing Factor	1.00			
Electric Fuel Share	5.0%	Fossil Fuel Share	95.0%	

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	kWh/ft².yr	5.4
	MJ/m².yr	209
Gas EUI	kWh/ft².yr	9.8
	MJ/m².yr	381
Market Composite EUI	kWh/ft².yr	9.6
	MJ/m².yr	372

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	0.0%	5.0%	20.0%	5.0%	70.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7	°C	44.6	°F
Condenser Water	30	°C	86	°F
Supply Air	14.0	°C	57.2	°F

Peak Cooling Load	88	W/m²	28	Btu/hr.ft²	429	ft²/Ton
Seasonal Cooling Load (Tertiary Load)	134.6	MJ/m².yr	3.5	kWh/ft².yr		

Sizing Factor: 1.00 — Operation (occ. period): 3000 hrs/year — Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C): 80.0%

Electric Fuel Share: 100.0% — Gas Fuel Share: 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenan

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	kWh/ft².yr	1.7
	MJ/m².yr	64
Natural Gas EUI	kWh/ft².yr	0.0
	MJ/m².yr	0
Market Composite EUI	kWh/ft².yr	1.7
	MJ/m².yr	64

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	60%				10%
Eff./COP	0.65				0.75

	Fossil	Elec. Res.
Fuel Share	70%	30%
Blended Efficiency	0.66	0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load): 30.0

Wetting Use Percentage: 90%

	All Electric EUI	Fossil Fuel EUI	Market Composite EUI
kWh/ft².yr	0.9	1.2	1.1
MJ/m².yr	33	45	41.5

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Office	50,000 to 100,000 ft²		Vancouver Island
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	4.8	L/s.m²	0.95	CFM/ft²
System Static Pressure CAV	850	Pa	3.4	wg
System Static Pressure VAV	850	Pa	3.4	wg
Fan Efficiency	52%			
Fan Motor Efficiency	88%			
Sizing Factor	1.00			
Fan Design Load CAV	9.0	W/m²	0.84	W/ft²
Fan Design Load VAV	9.0	W/m²	0.84	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	50%	50%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	50%	50%	50%	50%
Comments:				

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.3	L/s.m²	0.05	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.4	L/s.m²	0.07	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.5	W/m²	0.05	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.020	kW/kW	0.07	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	1.76	W/m²	0.16	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.005	L/s.m²	0.007	U.S. gpm/ft²
Pump Head Pressure	45	kPa	15	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.53	W/m²	0.05	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.004	L/s.m²	0.0056	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.8	W/m²	0.07	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	45.2	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	3.0	kWh/m².yr
Condenser Pump Energy Consumption	0.4	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.7	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	3.8	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI		
	kWh/ft².yr	4.9
	MJ/m².yr	191.1

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Office	50,000 to 100,000 ft²		Vancouver Island
Baseline			

EUI SUMMARY

TOTAL ALL END-USES: **Electricity:** **16.3** kWh/ft².yr **630.7** MJ/m².yr **Fossil Fue** **10.9** kWh/ft².yr **423.2** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	4.6	176.9
ARCHITECTURAL LIGHTING	0.3	12.4
SPECIAL PURPOSE LIGHTING	0.0	0.0
OTHER PLUG LOADS	0.3	12.8
HVAC FANS & PUMPS	4.9	191.1
REFRIGERATION	0.1	4.0
COMPUTER EQUIPMENT	3.0	114.8
ELEVATORS	0.3	11.6
OUTDOOR LIGHTING	0.8	32.2

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.3	10.4	9.3	361.6
SPACE COOLING	1.3	51.5	0.0	0.0
DOMESTIC HOT WATER	0.3	9.9	0.8	31.6
FOOD SERVICE EQUIPMENT	0.1	3.0	0.3	10.0
MISCELLANEOUS	0.0	0.0	0.5	20.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Retail	> 100,000 ft²		Vancouver Island
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.66	W/m².°C	0.12	Btu/hr.ft² . °F	Typical Building Size	24,000	m²	258,240	ft²
Roof U value (W/m².°C)	0.34	W/m².°C	0.06	Btu/hr.ft² . °F	Typical Footprint (m²)	24,000	m²	258,240	ft²
Glazing U value (W/m².°C)	3.50	W/m².°C	0.62	Btu/hr.ft² . °F	Footprint Aspect Ratio (L:W)	15			
					Percent Conditioned Space	100%			
					Percent Conditioned Space Defined as Exterior Zone	40%			
Window/Wall Ratio (WIWAR) (%)	0.10								
Shading Coefficient (SC)	0.78				Typical # Stories	1			
					Floor to Floor Height (m)	4.6	m	15.0	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	80%		0%		20%		0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	45	m²/person	484	ft²/person	%OA	20.93%
Occupancy Schedule Occ. Period	90%					
Occupancy Schedule Unocc. Period	0%					
Fresh Air Requirements or Outside Air	50	L/s.person	106	CFM/person		

Fresh Air Control Type *(enter a 1, 2 or 3): 1
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right:	0%			
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation	0.5	L/s.m²	0.10	CFM/ft²
	50%	operation (%)		

Sizing Factor	2.3			
Total Air Circulation or Design Air Flow	5.31	L/s.m²	1.05	CFM/ft²
Infiltration Rate	0.38	L/s.m²	0.07	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	7,875,583	
Peak Zone Sensible Load	2,523,126	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	117,376	
Total air circulation or Design air	5.31	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	23	°C	73.4	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	20.4	°C	68.72	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning — Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Retail	> 100,000 ft²		Vancouver Island
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	590	Lux	54.8	ft-candles
Floor Fraction (GLFF)	0.60			
Connected Load	15.2	W/m²	1.4	W/ft²
Occ. Period(Hrs./yr.)	4100			
Unocc. Period(Hrs./yr.)	4660			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	20%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	500	600	700	800				Total
% Distribution	10%	90%	0%	0%				100%
Weighted Average								**590**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)					100.0%			100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	4.1
	MJ/m².yr	159

ARCHITECTURAL LIGHTING

Light Level	575	Lux	53.4	ft-candles
Floor Fraction (ALFF)	0.15			
Connected Load	60.7	W/m²	5.6	W/ft²
Occ. Period(Hrs./yr.)	4100			
Unocc. Period(Hrs./yr.)	4660			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	30%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	400	500	600	700				Total
% Distribution	0%	25%	75%	0%				100%
Weighted Average								**575**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	60%	40%						100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	4.5
	MJ/m².yr	173

SPECIAL PURPOSE LIGHTING

Light Level	550.00	Lux	51.1	ft-candles
Floor Fraction (HBLFF)	0.25			
Connected Load	23.0	W/m²	2.1	W/ft²
Occ. Period(Hrs./yr.)	4100			
Unocc. Period(Hrs./yr.)	4660			
Usage During Occupied Period	100%			
Usage During Unoccupied Period	20%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 | 1.00

Light Level (Lux)	400	500	600	700				Total
% Distribution	0%	50%	50%	0%				100%
Weighted Average								**550**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)						100%		100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.7	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	2.7
	MJ/m².yr	104

TOTAL LIGHTING

Overall LPD	18.24 W/m²	EUI TOTAL	kWh/ft².yr	11.3
	1.70 W/ft²		MJ/m².yr	436

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Servers	Plug Loads
Measured Power (W/device)	55	51	100	200	217	
Density (device/occupant)	0.648828	0.648828	0.01	0.01	0.03	
Connected Load	0.8 W/m²	0.7 W/m²	0.0 W/m²	0.0 W/m²	0.5 W/m²	1.75 W/m²
	0.1 W/ft²	0.1 W/ft²	0.00 W/ft²	0.00 W/ft²	0.05 W/ft²	0.16 W/ft²
Diversity Occupied Period	90%	90%	90%	90%	100%	90%
Diversity Unoccupied Period	50%	50%	50%	50%	100%	25%
Operation Occ. Period (hrs./year)	2000	2000	2600	2600	2600	4100
Operation Unocc. Period (hrs./year)	6760	6760	6160	6160	6160	4660

Total end-use load (occupied period)	3.5 W/m²	0.3 W/ft²
Total end-use load (unocc. period)	1.7 W/m²	0.2 W/ft²
Usage during occupied period	100%	
Usage during unoccupied period	50%	

Computer Equipment	EUI	kWh/ft².yr	1.18
		MJ/m².yr	45.81
Plug Loads	EUI	kWh/ft².yr	0.79
		MJ/m².yr	30.59

FOOD SERVICE EQUIPMENT

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	0.3	EUI	kWh/ft².yr	0.3
	MJ/m².yr	10.0		MJ/m².yr	10.0

REFRIGERATION

Provide description below:

EUI	kWh/ft².yr	0.3
	MJ/m².yr	10.0

MISCELLANEOUS

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	0.1	EUI	kWh/ft².yr	0.0
	MJ/m².yr	5.0		MJ/m².yr	0.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **Large Retail** **Baseline**

SIZE: **> 100,000 ft²**

VINTAGE:

REGION: **Vancouver Island**

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)		5%		87%	0%	0%	2%	1%	5%	0%	100%
Seasonal Eff./COP	75%	80%	85%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff. (kW/kW)	1.33	1.25	1.18	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	16.1 W/m²	5.1 Btu/hr.ft²	
Seasonal Heating Load (Tertiary Load)	118 MJ/m².yr	3.0 kWh/ft².yr	
Sizing Factor	1.00		
Electric Fuel Share	8.0%	Fossil Fuel Share	92.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	2.5
MJ/m².yr	96

Gas EUI	
kWh/ft².yr	4.0
MJ/m².yr	157

Market Composite EUI	
kWh/ft².yr	3.9
MJ/m².yr	152

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	0.0%	3.0%	0.0%	3.0%	94.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7 °C	44.6 °F
Condenser Water	30 °C	86 °F
Supply Air	14.0 °C	57.2 °F

Peak Cooling Load	96 W/m²	30 Btu/hr.ft²	393 ft²/Ton
Seasonal Cooling Load (Tertiary Load)	124.2 MJ/m².yr	3.2 kWh/ft².yr	

Sizing Factor 1.00 — Operation (occ. period) 3000 hrs/year — Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C) 90.0%

Electric Fuel Share 100.0% — Gas Fuel Share 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	1.3
MJ/m².yr	51

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	1.3
MJ/m².yr	51

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	40%				10%
Eff./COP	0.65				0.75

	Fossil		Elec. Res.
Fuel Share	50%		50%
Blended Efficiency	0.67		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 30.0

Wetting Use Percentage 90%

All Electric EUI	
kWh/ft².yr	0.9
MJ/m².yr	33

Fossil Fuel EUI	
kWh/ft².yr	1.2
MJ/m².yr	45

Market Composite EUI	
kWh/ft².yr	1.0
MJ/m².yr	38.9

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Large Retail	**> 100,000 ft²**		**Vancouver Island**
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	5.3	L/s.m²	1.05	CFM/ft²
System Static Pressure CAV	650	Pa	2.6	wg
System Static Pressure VAV	650	Pa	2.6	wg
Fan Efficiency	60%			
Fan Motor Efficiency	80%			
Sizing Factor	1.00			
Fan Design Load CAV	7.2	W/m²	0.67	W/ft²
Fan Design Load VAV	7.2	W/m²	0.67	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	80%	20%	50%	50%
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	50%	50%	50%	50%
Comments:				

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.0	L/s.m²	0.00	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.1	L/s.m²	0.02	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.1	W/m²	0.01	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.027	kW/kW	0.09	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	2.60	W/m²	0.24	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.005	L/s.m²	0.008	U.S. gpm/ft²
Pump Head Pressure	0	kPa	0	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.00	W/m²	0.00	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.004	L/s.m²	0.0061	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.8	W/m²	0.08	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	40.9	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	0.9	kWh/m².yr
Condenser Pump Energy Consumption	0.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.8	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	4.1	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI	kWh/ft².yr	4.3
	MJ/m².yr	168.2

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Large Retail	**> 100,000 ft²**		**Vancouver Island**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**21.5** kWh/ft².yr	**833.5** MJ/m².yr	**Fossil Fue**	**4.7** kWh/ft².yr	**181.6** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	4.1	158.9
ARCHITECTURAL LIGHTING	4.5	173.4
SPECIAL PURPOSE LIGHTING	2.7	104.0
OTHER PLUG LOADS	0.8	30.6
HVAC FANS & PUMPS	4.3	168.2
REFRIGERATION	0.3	10.0
COMPUTER EQUIPMENT	1.2	45.8
ELEVATORS	0.3	11.6
OUTDOOR LIGHTING	1.3	50.9

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.2	7.7	3.7	144.2
SPACE COOLING	1.2	46.0	0.0	0.0
DOMESTIC HOT WATER	0.4	16.5	0.6	22.4
FOOD SERVICE EQUIPMENT	0.3	10.0	0.3	10.0
MISCELLANEOUS	0.0	0.0	0.1	5.0

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Medium Retail	**50,000 - 100,000 ft2**		**Vancouver Island**
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.59	W/m².°C	0.10	Btu/hr.ft² . °F	Typical Building Size	7,435	m²	80,000	ft²
Roof U value (W/m².°C)	0.32	W/m².°C	0.06	Btu/hr.ft² . °F	Typical Footprint (m²)	7,435	m²	80,000	ft²
Glazing U value (W/m².°C)	3.50	W/m².°C	0.62	Btu/hr.ft² . °F	Footprint Aspect Ratio (L:W)	5			
					Percent Conditioned Space	100%			
					Percent Conditioned Space Defined as Exterior Zone	45%			
Window/Wall Ratio (WIWAR) (%)	0.10								
Shading Coefficient (SC)	0.78				Typical # Stories	1			
					Floor to Floor Height (m)	5.0	m	16.5	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	100%		0%		0%		0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	25	m²/person	269	ft²/person
Occupancy Schedule Occ. Period	90%			
Occupancy Schedule Unocc. Period	0%			
Fresh Air Requirements or Outside Air	40	L/s.person	85	CFM/person

%OA 32.01%

Fresh Air Control Type *(enter a 1, 2 or 3) 1
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right: 34%
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation 0.5 L/s.m² 0.10 CFM/ft²
50% operation (%)

Sizing Factor	2			
Total Air Circulation or Design Air Flow	5.00	L/s.m²	0.98	CFM/ft²
Infiltration Rate	0.42	L/s.m²	0.08	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based	Total
Incidence of Use	0%		100%	100%
Switchover Point		KJ/kg.	18	°C
		Btu/lbm	64.4	°F

Summary of Design Parameters		
Peak Design Cooling Load	3,247,582	
Peak Zone Sensible Load	846,218	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	39,366	
Total air circulation or Design air	5.00	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	21	°C	69.8	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	21	°C	69.8	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Retail	50,000 - 100,000 ft2		Vancouver Island
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	590	Lux	54.8	ft-candles
Floor Fraction (GLFF)	0.55			
Connected Load	15.2	W/m²	1.4	W/ft²
Occ. Period(Hrs./yr.)	4100			
Unocc. Period(Hrs./yr.)	4660			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	20%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	500	600	700	800	Total
% Distribution	10%	90%	0%	0%	100%
Weighted Average					**590**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			0.0%	0%	100.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	3.8
	MJ/m².yr	146

ARCHITECTURAL LIGHTING

Light Level	575	Lux	53.4	ft-candles
Floor Fraction (ALFF)	0.15			
Connected Load	63.6	W/m²	5.9	W/ft²
Occ. Period(Hrs./yr.)	4100			
Unocc. Period(Hrs./yr.)	4660			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	35%			
Fixture Cleaning:				
Incidence of Practice	95%			
Interval	20%	years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	400	500	600	700	Total
% Distribution	0%	25%	75%	0%	100%
Weighted Average					**575**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	65%	35%					0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	4.9
	MJ/m².yr	190

SPECIAL PURPOSE LIGHTING

Light Level	550.00	Lux	51.1	ft-candles
Floor Fraction (HBLFF)	0.30			
Connected Load	23.0	W/m²	2.1	W/ft²
Occ. Period(Hrs./yr.)	4100			
Unocc. Period(Hrs./yr.)	4660			
Usage During Occupied Period	100%			
Usage During Unoccupied Period	15%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 | 1.00

Light Level (Lux)	400	500	600	700	Total
% Distribution	0%	50%	50%	0%	100%
Weighted Average					**550**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)						100%		100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.7	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	3.1
	MJ/m².yr	119

TOTAL LIGHTING	Overall LPD		EUI TOTAL		
		17.92 W/m²		kWh/ft².yr	11.7
		1.67 W/ft²		MJ/m².yr	454

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Servers		Plug Loads	
Measured Power (W/device)	55		51		100		200		217			
Density (device/occupant)	0.36046		0.36046		0.01		0.01		0.02			
Connected Load	0.8	W/m²	0.7	W/m²	0.0	W/m²	0.1	W/m²	0.5	W/m²	1.15	W/m²
	0.1	W/ft²	0.1	W/ft²	0.00	W/ft²	0.01	W/ft²	0.05	W/ft²	0.11	W/ft²
Diversity Occupied Period	90%		90%		90%		90%		100%		90%	
Diversity Unoccupied Period	50%		50%		50%		50%		100%		25%	
Operation Occ. Period (hrs./year)	2000		2000		2600		2600		2600		4100	
Operation Unocc. Period (hrs./year)	6760		6760		6160		6160		6160		4660	

Total end-use load (occupied period)	3.0	W/m²	0.3	W/ft²
Total end-use load (unocc. period)	1.6	W/m²	0.2	W/ft²
Usage during occupied period	100%			
Usage during unoccupied period	54%			

Computer Equipment	EUI	kWh/ft².yr	1.21
		MJ/m².yr	46.85
Plug Loads	EUI	kWh/ft².yr	0.52
		MJ/m².yr	20.10

FOOD SERVICE EQUIPMENT

Provide description below:

Small restaurants, food courts, kitchenettes

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	0.1	EUI	kWh/ft².yr	0.1
	MJ/m².yr	5.0		MJ/m².yr	5.0

REFRIGERATION

Provide description below:

EUI	kWh/ft².yr	0.2
	MJ/m².yr	8.6

MISCELLANEOUS

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	0.3	EUI	kWh/ft².yr	0.0
	MJ/m².yr	10.0		MJ/m².yr	0.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Medium Retail	**50,000 - 100,000 ft2**		**Vancouver Island**
Baseline			

SPACE HEATING

Heating Plant Type

							Electric			Other	
				Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	0%	2%	0%	60%	30%	0%	3%	0%	5%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff. (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	13.3 W/m²	4.2 Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	212 MJ/m².yr	5.5 kWh/ft².yr
Sizing Factor	1.00	
Electric Fuel Share	8.0%	Fossil Fuel Share 92.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	4.6
MJ/m².yr	180

Gas EUI	
kWh/ft².yr	7.2
MJ/m².yr	277

Market Composite EUI	
kWh/ft².yr	7.0
MJ/m².yr	269

SPACE COOLING

A/C Plant Type

			WSHP			Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	0.0%	3.0%	0.0%	3.0%	94.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7 °C	44.6 °F
Condenser Water	30 °C	86 °F
Supply Air	14.0 °C	57.2 °F

Peak Cooling Load	128 W/m²	41 Btu/hr.ft²	296 ft²/Ton
Seasonal Cooling Load (Tertiary Load)	155.7 MJ/m².yr	4.0 kWh/ft².yr	

Sizing Factor 1.00 Operation (occ. period) 3000 hrs/year Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C) 90.0%

Electric Fuel Share 100.0% Gas Fuel Share 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	1.8
MJ/m².yr	68

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	1.8
MJ/m².yr	68

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank					Boiler
System Present (%)	35%					10%
Eff./COP	0.65					0.75

	Fossil		Elec. Res.
Fuel Share	45%		55%
Blended Efficiency	0.67		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 30.0

Wetting Use Percentage 90%

All Electric EUI	
kWh/ft².yr	0.9
MJ/m².yr	33

Fossil Fuel EUI	
kWh/ft².yr	1.2
MJ/m².yr	45

Market Composite EUI	
kWh/ft².yr	1.0
MJ/m².yr	38.2

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Retail	50,000 - 100,000 ft2		Vancouver Island
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	5.0	L/s.m²	0.98	CFM/ft²
System Static Pressure CAV	500	Pa	2.0	wg
System Static Pressure VAV	500	Pa	2.0	wg
Fan Efficiency	60%			
Fan Motor Efficiency	88%			
Sizing Factor	1.00			
Fan Design Load CAV	4.7	W/m²	0.44	W/ft²
Fan Design Load VAV	4.7	W/m²	0.44	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	100%	0%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	75%	25%	50%	50%
Comments:				

EXHAUST FANS

Washroom Exhaust	50	L/s.washroom	106	CFM/washroom
Washroom Exhaust per gross unit are	0.0	L/s.m²	0.00	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.1	L/s.m²	0.02	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.2	W/m²	0.01	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.020	kW/kW	0.07	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	2.56	W/m²	0.24	W/ft²

Condenser Pump

Pump Design Flow	0.000	L/s.KW	0.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.000	L/s.m²	0.000	U.S. gpm/ft²
Pump Head Pressure	45	kPa	15	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.00	W/m²	0.00	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.006	L/s.m²	0.0081	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	0	kPa	0	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.0	W/m²	0.00	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	35.2	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	0.9	kWh/m².yr
Condenser Pump Energy Consumption	0.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.8	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	0.0	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI		
	kWh/ft².yr	3.4
	MJ/m².yr	133.2

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Medium Retail	**50,000 - 100,000 ft2**		**Vancouver Island**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**21.3**	kWh/ft².yr	**824.8**	MJ/m².yr	**Fossil Fuel**	**7.5**	kWh/ft².yr	**290.1**	MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	3.8	145.7
ARCHITECTURAL LIGHTING	4.9	189.8
SPECIAL PURPOSE LIGHTING	3.1	119.0
OTHER PLUG LOADS	0.5	20.1
HVAC FANS & PUMPS	3.4	133.2
REFRIGERATION	0.2	8.6
COMPUTER EQUIPMENT	1.2	46.9
ELEVATORS	0.3	11.6
OUTDOOR LIGHTING	1.3	50.9

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.4	14.4	6.6	255.0
SPACE COOLING	1.6	61.6	0.0	0.0
DOMESTIC HOT WATER	0.5	18.1	0.5	20.1
FOOD SERVICE EQUIPMENT	0.1	5.0	0.1	5.0
MISCELLANEOUS	0.0	0.0	0.3	10.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Food Retail	**0**		**Vancouver Island**
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.64	W/m².°C	0.11	Btu/hr.ft² . °F	Typical Building Size	4,000	m²	43,040	ft²
Roof U value (W/m².°C)	0.34	W/m².°C	0.06	Btu/hr.ft² . °F	Typical Footprint (m²)	4,000	m²	43,040	ft²
Glazing U value (W/m².°C)	3.50	W/m².°C	0.62	Btu/hr.ft² . °F	Footprint Aspect Ratio (L:W)	1			
					Percent Conditioned Space	100%			
					Percent Conditioned Space Defined as Exterior Zone	40%			
Window/Wall Ratio (WIWAR) (%)	0.11								
Shading Coefficient (SC)	0.79				Typical # Stories	1			
					Floor to Floor Height (m)	7.0	m	23.0	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	100%		0%		0%		0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	45	m²/person	484	ft²/person	%OA 34.46%
Occupancy Schedule Occ. Period	90%				
Occupancy Schedule Unocc. Period	0%				
Fresh Air Requirements or Outside Air	70	L/s.person	148	CFM/person	

Fresh Air Control Type *(enter a 1, 2 or 3) 1
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right: 0%
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation 0.5 L/s.m² 0.10 CFM/ft²
50% operation (%)

Sizing Factor	1.65			
Total Air Circulation or Design Air Flow	4.51	L/s.m²	0.89	CFM/ft²
Infiltration Rate	0.32	L/s.m²	0.06	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based	Total
Incidence of Use	0%		100%	100%
Switchover Point		KJ/kg.	18	°C
		Btu/lbm	64.4	°F

Summary of Design Parameters		
Peak Design Cooling Load	1,739,162	
Peak Zone Sensible Load	498,416	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	23,186	
Total air circulation or Design air	4.51	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	22	°C	71.6	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	20.4	°C	68.72	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Food Retail	0		Vancouver Island
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	600	Lux	55.8	ft-candles
Floor Fraction (GLFF)	0.40			
Connected Load	15.5	W/m²	1.4	W/ft²
Occ. Period(Hrs./yr.)	4100			
Unocc. Period(Hrs./yr.)	4660			
Usage During Occupied Period	100%			
Usage During Unoccupied Period	40%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	500	600	700	800				Total
% Distribution	25%	50%	25%	0%				100%
Weighted Average								**600**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)					100.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	3.4
	MJ/m².yr	133

ARCHITECTURAL LIGHTING

Light Level	640	Lux	59.5	ft-candles
Floor Fraction (ALFF)	0.20			
Connected Load	47.8	W/m²	4.4	W/ft²
Occ. Period(Hrs./yr.)	4100			
Unocc. Period(Hrs./yr.)	4660			
Usage During Occupied Period	100%			
Usage During Unoccupied Period	50%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	300	500	700	1000				Total
% Distribution	0%	30%	70%	0%				100%
Weighted Average								**640**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	30%	70%						100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	5.7
	MJ/m².yr	221

SPECIAL PURPOSE LIGHTING

Light Level	500.00	Lux	46.5	ft-candles
Floor Fraction (HBLFF)	0.40			
Connected Load	23.3	W/m²	2.2	W/ft²
Occ. Period(Hrs./yr.)	4100			
Unocc. Period(Hrs./yr.)	4660			
Usage During Occupied Period	100%			
Usage During Unoccupied Period	50%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 — 1.00

Light Level (Lux)	300	500	700	1000				Total
% Distribution	20%	60%	20%	0%				100%
Weighted Average								**500**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)						100%		100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	5.6
	MJ/m².yr	216

TOTAL LIGHTING

Overall LPD	15.76 W/m²	EUI TOTAL	kWh/ft².yr	14.7
	1.47 W/ft²		MJ/m².yr	570

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Servers		Plug Loads	
Measured Power (W/device)	55		51		100		200		217			
Density (device/occupant)	0.648828		0.648828		0.01		0.01		0.03			
Connected Load	0.8	W/m²	0.7	W/m²	0.0	W/m²	0.0	W/m²	0.5	W/m²	2.85	W/m²
	0.1	W/ft²	0.1	W/ft²	0.00	W/ft²	0.00	W/ft²	0.05	W/ft²	0.26	W/ft²
Diversity Occupied Period	90%		90%		90%		90%		100%		90%	
Diversity Unoccupied Period	50%		50%		50%		50%		100%		50%	
Operation Occ. Period (hrs./year)	2000		2000		2600		2600		2600		4100	
Operation Unocc. Period (hrs./year)	6760		6760		6160		6160		6160		4660	

Total end-use load (occupied period)	4.5	W/m²	0.4	W/ft²
Total end-use load (unocc. period)	2.7	W/m²	0.3	W/ft²
Usage during occupied period	100%			
Usage during unoccupied period	61%			

	EUI		
Computer Equipment	EUI	kWh/ft².yr	1.18
		MJ/m².yr	45.81
Plug Loads	EUI	kWh/ft².yr	1.59
		MJ/m².yr	61.77

FOOD SERVICE EQUIPMENT

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	2.3	EUI	kWh/ft².yr	0.4
	MJ/m².yr	90.0		MJ/m².yr	15.0

REFRIGERATION

Provide description below:

Commercial refrigeration display cases

EUI	kWh/ft².yr	29.0
	MJ/m².yr	1125.0

MISCELLANEOUS

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	0.5	EUI	kWh/ft².yr	0.0
	MJ/m².yr	20.0		MJ/m².yr	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Food Retail	0		Vancouver Island
Baseline			

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	3%	10%	2%	65%	10%	0%	4%	1%	5%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff. (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	18.3 W/m²	5.8 Btu/hr.ft²	
Seasonal Heating Load (Tertiary Load)	239 MJ/m².yr	6.2 kWh/ft².yr	
Sizing Factor	1.00		
Electric Fuel Share	10.0%	Fossil Fuel Share	90.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	4.7
MJ/m².yr	184

Gas EUI	
kWh/ft².yr	8.1
MJ/m².yr	313

Market Composite EUI	
kWh/ft².yr	7.8
MJ/m².yr	300

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	0.0%	0.0%	0.0%		100.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7 °C	44.6 °F
Condenser Water	30 °C	86 °F
Supply Air	14.0 °C	57.2 °F

Peak Cooling Load	127 W/m²	40 Btu/hr.ft²	297 ft²/Ton
Seasonal Cooling Load (Tertiary Load)	160.7 MJ/m².yr	4.1 kWh/ft².yr	

Sizing Factor 1.00 — Operation (occ. period) 3000 hrs/year — Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C) 85.0%

Electric Fuel Share 100.0% — Gas Fuel Share 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenan

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	1.6
MJ/m².yr	62

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	1.6
MJ/m².yr	62

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	60%				5%
Eff./COP	0.65				0.75

	Fossil		Elec. Res.
Fuel Share	65%		35%
Blended Efficiency	0.66		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 65.0

Wetting Use Percentage 90%

All Electric EUI	
kWh/ft².yr	1.8
MJ/m².yr	71

Fossil Fuel EUI	
kWh/ft².yr	2.6
MJ/m².yr	99

Market Composite EUI	
kWh/ft².yr	2.3
MJ/m².yr	89.2

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Food Retail	0		Vancouver Island
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	4.5	L/s.m²	0.89	CFM/ft²
System Static Pressure CAV	500	Pa	2.0	wg
System Static Pressure VAV	1000	Pa	4.0	wg
Fan Efficiency	60%			
Fan Motor Efficiency	80%			
Sizing Factor	1.00			
Fan Design Load CAV	4.7	W/m²	0.44	W/ft²
Fan Design Load VAV	9.4	W/m²	0.87	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	100%	0%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	40%	60%	100%	0%
Comments:				

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m²	0.01	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.2	L/s.m²	0.03	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.2	W/m²	0.02	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.027	kW/kW	0.09	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	3.44	W/m²	0.32	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.007	L/s.m²	0.010	U.S. gpm/ft²
Pump Head Pressure	0	kPa	0	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.00	W/m²	0.00	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.005	L/s.m²	0.0081	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	0	kPa	0	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.0	W/m²	0.00	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	26.3	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	1.8	kWh/m².yr
Condenser Pump Energy Consumption	0.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	1.0	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	0.0	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI	kWh/ft².yr	2.7
	MJ/m².yr	104.9

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Food Retail	**0**		**Vancouver Island**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES: **Electricity:** **53.3** kWh/ft².yr **2,064.5** MJ/m².yr **Fossil Fue** **11.8** kWh/ft².yr **456.3** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	3.4	133.1
ARCHITECTURAL LIGHTING	5.7	221.4
SPECIAL PURPOSE LIGHTING	5.6	215.8
OTHER PLUG LOADS	1.6	61.8
HVAC FANS & PUMPS	2.7	104.9
REFRIGERATION	29.0	1,125.0
COMPUTER EQUIPMENT	1.2	45.8
ELEVATORS	0.3	11.6
OUTDOOR LIGHTING	0.9	33.9

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.5	18.4	7.3	282.0
SPACE COOLING	1.4	52.8	0.0	0.0
DOMESTIC HOT WATER	0.6	25.0	1.7	64.2
FOOD SERVICE EQUIPMENT	0.4	15.0	2.3	90.0
MISCELLANEOUS	0.0	0.0	0.5	20.0

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Hotel	0		Vancouver Island
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.82	W/m².°C	0.14	Btu/hr.ft² . °F	Typical Building Size	20,000	m²	215,200	ft²
Roof U value (W/m².°C)	0.34	W/m².°C	0.06	Btu/hr.ft² . °F	Typical Footprint (m²)	2,000	m²	21,520	ft²
Glazing U value (W/m².°C)	3.50	W/m².°C	0.62	Btu/hr.ft² . °F	Footprint Aspect Ratio (L:W)	3			
					Percent Conditioned Space	100%			
					Percent Conditioned Space Defined as Exterior Zone	45%			
Window/Wall Ratio (WIWAR) (%)	0.30								
Shading Coefficient (SC)	0.65				Typical # Stories	10			
					Floor to Floor Height (m)	3.7	m	12.0	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	66%		0%		0%	34%	0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	60	m²/person	646	ft²/person	%OA	34.69%
Occupancy Schedule Occ. Period	45%					
Occupancy Schedule Unocc. Period	80%					
Fresh Air Requirements or Outside Air	70	L/s.person	148	CFM/person		

Fresh Air Control Type *(enter a 1, 2 or 3) 1
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right:	15%			
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation	0.5	L/s.m²	0.10	CFM/ft²
	50%	operation (%)		

Sizing Factor	1.6			
Total Air Circulation or Design Air Flow	3.36	L/s.m²	0.66	CFM/ft²
Infiltration Rate	0.38	L/s.m²	0.07	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	6,529,412	
Peak Zone Sensible Load	1,914,862	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	89,079	
Total air circulation or Design air	3.36	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	23	°C	73.4	°F	15	°C	59	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	20.6	°C	69.08	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning — Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Hotel	0		Vancouver Island
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	248	Lux	23.0	ft-candles
Floor Fraction (GLFF)	0.20			
Connected Load	6.4	W/m²	0.6	W/ft²
Occ. Period(Hrs./yr.)	3000			
Unocc. Period(Hrs./yr.)	5760			
Usage During Occupied Period	85%			
Usage During Unoccupied Period	90%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	125	300	400	500				Total
% Distribution	30%	70%						100%
Weighted Average								**247.5**
	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			0.0%		100.0%			100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	0.9
	MJ/m².yr	36

ARCHITECTURAL LIGHTING

Light Level	220	Lux	20.4	ft-candles
Floor Fraction (ALFF)	0.80			
Connected Load	15.3	W/m²	1.4	W/ft²
Occ. Period(Hrs./yr.)	2500			
Unocc. Period(Hrs./yr.)	6260			
Usage During Occupied Period	60%			
Usage During Unoccupied Period	40%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	100	200	300	400				Total
% Distribution	20%	50%	20%	10%				100%
Weighted Average								**220**
	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	25%	75%						100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	4.6
	MJ/m².yr	177

SPECIAL PURPOSE LIGHTING

Light Level	0.00	Lux	0.0	ft-candles
Floor Fraction (HBLFF)	0.00			
Connected Load	0.0	W/m²	0.0	W/ft²
Occ. Period(Hrs./yr.)	4000			
Unocc. Period(Hrs./yr.)	4760			
Usage During Occupied Period	0%			
Usage During Unoccupied Period	100%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 | 1.00

Light Level (Lux)	300	500	700	1000				Total
% Distribution		0%	0%	0%				0%
Weighted Average								**0**
	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)								0.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	0.0
	MJ/m².yr	0

TOTAL LIGHTING

Overall LPD	13.53 W/m²	EUI TOTAL	kWh/ft².yr	5.5
	1.26 W/ft²		MJ/m².yr	212

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Servers	Plug Loads
Measured Power (W/device)	55	51	100	200	217	
Density (device/occupant)	0.3	0.3	0.05	0.033	0.03	
Connected Load	0.3 W/m²	0.3 W/m²	0.1 W/m²	0.1 W/m²	0.5 W/m²	2.2 W/m²
	0.0 W/ft²	0.0 W/ft²	0.01 W/ft²	0.01 W/ft²	0.05 W/ft²	0.20 W/ft²
Diversity Occupied Period	90%	90%	90%	90%	100%	70%
Diversity Unoccupied Period	50%	50%	50%	50%	100%	25%
Operation Occ. Period (hrs./year)	2500	2500	2500	2500	2500	3000
Operation Unocc. Period (hrs./year)	6260	6260	6260	6260	6260	5760

Total end-use load (occupied period)	2.7 W/m²	0.3 W/ft²
Total end-use load (unocc. period)	1.4 W/m²	0.1 W/ft²
Usage during occupied period	100%	
Usage during unoccupied period	53%	

Computer Equipment	EUI	kWh/ft².yr	0.78
		MJ/m².yr	30.14
Plug Loads	EUI	kWh/ft².yr	0.72
		MJ/m².yr	28.04

FOOD SERVICE EQUIPMENT

Provide description below:

Commercial food preparation

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	2.6	EUI	kWh/ft².yr	0.5
	MJ/m².yr	100.0		MJ/m².yr	17.5

REFRIGERATION

Provide description below:

Walk-in coolers/freezers, reach-in coolers/freezers, refrigerated buffet cases

EUI	kWh/ft².yr	0.6
	MJ/m².yr	25.0

MISCELLANEOUS

Provide description below:

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	1.5	EUI	kWh/ft².yr	0.0
	MJ/m².yr	60.0		MJ/m².yr	0.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Hotel	0		Vancouver Island
Baseline			

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	5%	55%	10%	15%	0%	0%	5%	2%	8%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff. (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load: 17.2 W/m² — 5.5 Btu/hr.ft²
Seasonal Heating Load (Tertiary Load): 229 MJ/m².yr — 5.9 kWh/ft².yr
Sizing Factor: 1.00

Electric Fuel Share: 15.0% — Fossil Fuel Share: 85.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	4.6
MJ/m².yr	177
Gas EUI	
kWh/ft².yr	7.4
MJ/m².yr	287
Market Composite EUI	
kWh/ft².yr	7.0
MJ/m².yr	270

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	0.0%	33.3%	0.0%	33.3%	33.4%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7	°C	44.6	°F
Condenser Water	30	°C	86	°F
Supply Air	15.0	°C	59	°F

Peak Cooling Load: 86 W/m² — 27 Btu/hr.ft² — 439 ft²/Ton
Seasonal Cooling Load (Tertiary Load): 114.6 MJ/m².yr — 3.0 kWh/ft².yr

Sizing Factor: 0.90 — Operation (occ. period): 3000 hrs/year — Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C): 80.0%

Electric Fuel Share: 100.0% — Gas Fuel Share: 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	1.2
MJ/m².yr	48
Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0
Market Composite EUI	
kWh/ft².yr	1.2
MJ/m².yr	48

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	20%				60%
Eff./COP	0.65				0.75

	Fossil	Elec. Res.
Fuel Share	80%	20%
Blended Efficiency	0.73	0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load): 225.0

Wetting Use Percentage: 90%

	All Electric EUI	Fossil Fuel EUI	Market Composite EUI
kWh/ft².yr	6.4	8.0	7.7
MJ/m².yr	247	310	297.7

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Hotel	0		Vancouver Island
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	3.4	L/s.m²	0.66	CFM/ft²
System Static Pressure CAV	500	Pa	2.0	wg
System Static Pressure VAV	750	Pa	3.0	wg
Fan Efficiency	60%			
Fan Motor Efficiency	70%			
Sizing Factor	1.00			
Fan Design Load CAV	4.0	W/m²	0.37	W/ft²
Fan Design Load VAV	6.0	W/m²	0.56	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	66%	0%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	75%	25%	100%	0%

Comments:

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m²	0.02	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.2	L/s.m²	0.04	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.3	W/m²	0.02	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.023	kW/kW	0.08	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	1.96	W/m²	0.18	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.005	L/s.m²	0.007	U.S. gpm/ft²
Pump Head Pressure	45	kPa	15	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.51	W/m²	0.05	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.004	L/s.m²	0.0055	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.7	W/m²	0.07	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	19.7	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	2.3	kWh/m².yr
Condenser Pump Energy Consumption	1.1	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.7	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	3.7	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI		
	kWh/ft².yr	2.6
	MJ/m².yr	99.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Large Hotel	**0**		**Vancouver Island**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**14.4**	kWh/ft².yr	**558.2**	MJ/m².yr	**Fossil Fue**	**16.8** kWh/ft².yr	**651.8**	MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr	**END USE:**	Electricity		Fossil Fuel	
				kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	0.9	35.6					
ARCHITECTURAL LIGHTING	4.6	176.6	SPACE HEATING	0.7	26.5	6.3	243.5
SPECIAL PURPOSE LIGHTING	0.0	0.0	SPACE COOLING	1.0	38.4	0.0	0.0
OTHER PLUG LOADS	0.7	28.0	DOMESTIC HOT WATER	1.3	49.5	6.4	248.3
HVAC FANS & PUMPS	2.6	99.0	FOOD SERVICE EQUIPMENT	0.5	17.5	2.6	100.0
REFRIGERATION	0.6	25.0	MISCELLANEOUS	0.0	0.0	1.5	60.0
COMPUTER EQUIPMENT	0.8	30.1					
ELEVATORS	0.3	11.6					
OUTDOOR LIGHTING	0.5	20.4					

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Hotel	50,000 to 100,000 ft²		Vancouver Island
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.78	W/m².°C	0.14	Btu/hr.ft² . °F	Typical Building Size	6,000	m²	64,560	ft²
Roof U value (W/m².°C)	0.33	W/m².°C	0.06	Btu/hr.ft² . °F	Typical Footprint (m²)	1,500	m²	16,140	ft²
Glazing U value (W/m².°C)	3.50	W/m².°C	0.62	Btu/hr.ft² . °F	Footprint Aspect Ratio (L:W)	4			
					Percent Conditioned Space	100%			
					Percent Conditioned Space Defined as Exterior Zone	45%			
Window/Wall Ratio (WIWAR) (%)	0.40								
Shading Coefficient (SC)	0.57				Typical # Stories	4			
					Floor to Floor Height (m)	3.7	m	12.0	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	66%		0%		0%	34%	0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	50	m²/person	538	ft²/person	%OA 23.54%
Occupancy Schedule Occ. Period	50%				
Occupancy Schedule Unocc. Period	80%				
Fresh Air Requirements or Outside Air	40	L/s.person	85	CFM/person	

Fresh Air Control Type *(enter a 1, 2 or 3) | 1 | If Fresh Air Control Type = "2" enter % FA. to the right: | 15%
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air) | If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation | 0.5 L/s.m² | 0.10 CFM/ft²
50% operation (%)

Sizing Factor	1.4			
Total Air Circulation or Design Air Flow	3.40	L/s.m²	0.67	CFM/ft²
Infiltration Rate	0.50	L/s.m²	0.10	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based	Total
Incidence of Use	0%		100%	100%
Switchover Point		KJ/kg.	18 °C	
		Btu/lbm	64.4 °F	

Summary of Design Parameters		
Peak Design Cooling Load	1,620,164	
Peak Zone Sensible Load	663,454	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	30,864	
Total air circulation or Design air	3.40	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	22	°C	71.6	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	21	°C	69.8	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning — Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Hotel	50,000 to 100,000 ft²		Vancouver Island
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	239 Lux	22.2	ft-candles
Floor Fraction (GLFF)	0.20		
Connected Load	6.2 W/m²	0.6	W/ft²
Occ. Period(Hrs./yr.)	3000		
Unocc. Period(Hrs./yr.)	5760		
Usage During Occupied Period	75%		
Usage During Unoccupied Period	75%		
Fixture Cleaning:			
Incidence of Practice			
Interval	years		
Relamping Strategy & Incidence of Practice	Group	Spot	

Light Level (Lux)	125	300	700	1000				Total
% Distribution	35%	65%	0%	0%				100%
Weighted Average								**238.75**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)					100.0%			100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	0.8
	MJ/m².yr	29

ARCHITECTURAL LIGHTING

Light Level	151 Lux	14.1	ft-candles
Floor Fraction (ALFF)	0.80		
Connected Load	11.8 W/m²	1.1	W/ft²
Occ. Period(Hrs./yr.)	2100		
Unocc. Period(Hrs./yr.)	6660		
Usage During Occupied Period	45%		
Usage During Unoccupied Period	60%		
Fixture Cleaning:			
Incidence of Practice			
Interval	years		
Relamping Strategy & Incidence of Practice	Group	Spot	

Light Level (Lux)	100	125	150	300				Total
% Distribution	0%	85%	0%	15%				100%
Weighted Average								**151.25**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	33%	67%						100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	4.3
	MJ/m².yr	167

SPECIAL PURPOSE LIGHTING

Light Level	0.00 Lux	0.0	ft-candles
Floor Fraction (HBLFF)	0.00		
Connected Load	0.0 W/m²	0.0	W/ft²
Occ. Period(Hrs./yr.)	4000		
Unocc. Period(Hrs./yr.)	4760		
Usage During Occupied Period	0%		
Usage During Unoccupied Period	100%		
Fixture Cleaning:			
Incidence of Practice			
Interval	years		
Relamping Strategy & Incidence of Practice	Group	Spot	

Floor fraction check: should = 1.00 | 1.00

Light Level (Lux)	300	500	700	1000				Total
% Distribution		0%	0%	0%				0%
Weighted Average								**0**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)								0.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	0.0
	MJ/m².yr	0

TOTAL LIGHTING	Overall LPD	10.65 W/m²	EUI TOTAL	kWh/ft².yr	5.1
		0.99 W/ft²		MJ/m².yr	197

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Servers	Plug Loads
Measured Power (W/device)	55	51	100	200	217	
Density (device/occupant)	0.3	0.3	0.05	0.033	0.03	
Connected Load	0.3 W/m²	0.3 W/m²	0.1 W/m²	0.1 W/m²	0.5 W/m²	2.1 W/m²
	0.0 W/ft²	0.0 W/ft²	0.01 W/ft²	0.01 W/ft²	0.05 W/ft²	0.20 W/ft²
Diversity Occupied Period	90%	90%	90%	90%	100%	70%
Diversity Unoccupied Period	50%	50%	50%	50%	100%	25%
Operation Occ. Period (hrs./year)	2500	2500	2500	2500	2500	3000
Operation Unocc. Period (hrs./year)	6260	6260	6260	6260	6260	5760

Total end-use load (occupied period)	2.8 W/m²	0.3 W/ft²
Total end-use load (unocc. period)	1.5 W/m²	0.1 W/ft²
Usage during occupied period	100%	
Usage during unoccupied period	53%	

Computer Equipment	EUI	kWh/ft².yr	0.85
		MJ/m².yr	32.93
Plug Loads	EUI	kWh/ft².yr	0.69
		MJ/m².yr	26.76

FOOD SERVICE EQUIPMENT

Provide description below:

Kitchen services

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	1.5	EUI	kWh/ft².yr	1.0
	MJ/m².yr	60.0		MJ/m².yr	40.0

REFRIGERATION

Provide description below:

Walk-in coolers/freezers, reach-in coolers/freezers, refrigerated buffet cases

EUI	kWh/ft².yr	0.6
	MJ/m².yr	25.0

MISCELLANEOUS

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	1.5	EUI	kWh/ft².yr	0.0
	MJ/m².yr	60.0		MJ/m².yr	0.0

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Medium Hotel	**50,000 to 100,000 ft²**		**Vancouver Island**
Baseline			

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	5%	5%	5%	45%	0%	0%	2%	0%	38%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff.) (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	26.3	W/m²	8.3	Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	246	MJ/m².yr	6.3	kWh/ft².yr
Sizing Factor	1.00			
Electric Fuel Share	40.0%	Fossil Fuel Share	60.0%	

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	6.2
MJ/m².yr	240

Gas EUI	
kWh/ft².yr	8.3
MJ/m².yr	321

Market Composite EUI	
kWh/ft².yr	7.5
MJ/m².yr	289

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	0.0%	0.0%	0.0%	25.0%	75.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7	°C	44.6	°F
Condenser Water	30	°C	86	°F
Supply Air	14.0	°C	57.2	°F

Peak Cooling Load	67	W/m²	21	Btu/hr.ft²	563	ft²/Ton
Seasonal Cooling Load (Tertiary Load)	105.4	MJ/m².yr	2.7	kWh/ft².yr		

Sizing Factor: 0.85 — Operation (occ. period): 3000 hrs/year — Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C): 60.0%

Electric Fuel Share: 100.0% — Gas Fuel Share: 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	1.2
MJ/m².yr	46

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	1.2
MJ/m².yr	46

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Std. Tank	PV Tank	Cond. Tnk	Std. Boiler	Cnd. Boil.
System Present (%)	40%				30%
Eff./COP	0.65				0.75

	Fossil	Elec. Res.
Fuel Share	70%	30%
Blended Efficiency	0.69	0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load): 225.0

Wetting Use Percentage: 90%

All Electric EUI	
kWh/ft².yr	6.4
MJ/m².yr	247

Fossil Fuel EUI	
kWh/ft².yr	8.4
MJ/m².yr	325

Market Composite EUI	
kWh/ft².yr	7.8
MJ/m².yr	301.5

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Hotel	50,000 to 100,000 ft²		Vancouver Island
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	3.4	L/s.m²	0.67	CFM/ft²
System Static Pressure CAV	250	Pa	1.0	wg
System Static Pressure VAV	250	Pa	1.0	wg
Fan Efficiency	45%			
Fan Motor Efficiency	70%			
Sizing Factor	1.00			
Fan Design Load CAV	2.7	W/m²	0.25	W/ft²
Fan Design Load VAV	2.7	W/m²	0.25	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	66%	0%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	80%	20%	100%	0%

Comments:

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m²	0.03	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.2	L/s.m²	0.05	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.3	W/m²	0.03	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.027	kW/kW	0.09	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	1.82	W/m²	0.17	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.004	L/s.m²	0.005	U.S. gpm/ft²
Pump Head Pressure	45	kPa	15	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.40	W/m²	0.04	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.003	L/s.m²	0.0043	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.6	W/m²	0.05	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	13.7	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	2.7	kWh/m².yr
Condenser Pump Energy Consumption	0.9	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.8	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	2.9	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI	kWh/ft².yr	2.0
	MJ/m².yr	75.6

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: Medium Hotel Baseline
SIZE: 50,000 to 100,000 ft²
VINTAGE:
REGION: Vancouver Island

EUI SUMMARY

TOTAL ALL END-USES: **Electricity:** 16.1 kWh/ft².yr 623.2 MJ/m².yr **Fossil Fuel** 13.9 kWh/ft².yr 540.0 MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	0.8	29.2
ARCHITECTURAL LIGHTING	4.3	167.5
SPECIAL PURPOSE LIGHTING	0.0	0.0
OTHER PLUG LOADS	0.7	26.8
HVAC FANS & PUMPS	2.0	75.6
REFRIGERATION	0.6	25.0
COMPUTER EQUIPMENT	0.9	32.9
ELEVATORS	0.3	11.6
OUTDOOR LIGHTING	0.4	17.0

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	2.5	96.2	5.0	192.7
SPACE COOLING	0.7	27.3	0.0	0.0
DOMESTIC HOT WATER	1.9	74.2	5.9	227.3
FOOD SERVICE EQUIPMENT	1.0	40.0	1.5	60.0
MISCELLANEOUS	0.0	0.0	1.5	60.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Hospital	**0**		**Vancouver Island**
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.63	W/m².°C	0.11	Btu/hr.ft² . °F	Typical Building Size	14,000	m²	150,640	ft²
Roof U value (W/m².°C)	0.34	W/m².°C	0.06	Btu/hr.ft² . °F	Typical Footprint (m²)	1,400	m²	15,064	ft²
Glazing U value (W/m².°C)	3.50	W/m².°C	0.62	Btu/hr.ft² . °F	Footprint Aspect Ratio (L:W)	2			
					Percent Conditioned Space	100%			
					Percent Conditioned Space Defined as Exterior Zone	45%			
Window/Wall Ratio (WIWAR) (%)	0.20								
Shading Coefficient (SC)	0.66				Typical # Stories	8			
					Floor to Floor Height (m)	4.3	m	14.0	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	50%		0%		20%	30%	0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	30	m²/person	323	ft²/person	%OA 40.18%
Occupancy Schedule Occ. Period	90%				
Occupancy Schedule Unocc. Period	75%				
Fresh Air Requirements or Outside Air	57	L/s.person	121	CFM/person	

Fresh Air Control Type *(enter a 1, 2 or 3): 1
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right:	15%			
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation	0.5	L/s.m²	0.10	CFM/ft²
	50%	operation (%)		

Sizing Factor	2.3			
Total Air Circulation or Design Air Flow	4.73	L/s.m²	0.93	CFM/ft²
Infiltration Rate	0.32	L/s.m²	0.06	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	5,570,388	
Peak Zone Sensible Load	1,311,123	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	60,993	
Total air circulation or Design air	4.73	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	24	°C	75.2	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	22	°C	71.6	°F	16	°C	60.8	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	22	°C	71.6	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning — Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Hospital	0		Vancouver Island
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	475	Lux	44.1	ft-candles
Floor Fraction (GLFF)	0.95			
Connected Load	12.3	W/m²	1.1	W/ft²
Occ. Period(Hrs./yr.)	3100			
Unocc. Period(Hrs./yr.)	5660			
Usage During Occupied Period	80%			
Usage During Unoccupied Period	35%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	100	250	700	800	Total
% Distribution		50%	50%	0%	100%
Weighted Average					**475**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)					100.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI		
EUI	kWh/ft².yr	4.8
	MJ/m².yr	187

ARCHITECTURAL LIGHTING

Light Level	250	Lux	23.2	ft-candles
Floor Fraction (ALFF)	0.05			
Connected Load	21.2	W/m²	2.0	W/ft²
Occ. Period(Hrs./yr.)	4000			
Unocc. Period(Hrs./yr.)	4760			
Usage During Occupied Period	90%			
Usage During Unoccupied Period	75%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	200	300	500	700	Total
% Distribution	50%	50%	0%	0%	100%
Weighted Average					**250**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	40%	60%						100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI		
EUI	kWh/ft².yr	0.7
	MJ/m².yr	27

SPECIAL PURPOSE LIGHTING

Light Level	0.00	Lux	0.0	ft-candles
Floor Fraction (HBLFF)	0.00			
Connected Load	0.0	W/m²	0.0	W/ft²
Occ. Period(Hrs./yr.)	4000			
Unocc. Period(Hrs./yr.)	4760			
Usage During Occupied Period	0%			
Usage During Unoccupied Period	100%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 | 1.00

Light Level (Lux)	300	500	700	1000	Total
% Distribution		0%	0%	0%	0%
Weighted Average					**0**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)								0.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI		
EUI	kWh/ft².yr	0.0
	MJ/m².yr	0

TOTAL LIGHTING

Overall LPD	12.72 W/m²	EUI TOTAL	kWh/ft².yr	5.5
	1.18 W/ft²		MJ/m².yr	215

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Servers		Plug Loads	
Measured Power (W/device)	55		51		100		200		217			
Density (device/occupant)	0.477744		0.477744		0.02		0.02		0.04			
Connected Load	0.9	W/m²	0.8	W/m²	0.1	W/m²	0.1	W/m²	0.5	W/m²	3.85	W/m²
	0.1	W/ft²	0.1	W/ft²	0.01	W/ft²	0.01	W/ft²	0.05	W/ft²	0.36	W/ft²
Diversity Occupied Period	90%		90%		90%		90%		100%		90%	
Diversity Unoccupied Period	50%		50%		50%		50%		100%		25%	
Operation Occ. Period (hrs./year)	2000		2000		2600		2600		2600		4100	
Operation Unocc. Period (hrs./year)	6760		6760		6160		6160		6160		4660	

Total end-use load (occupied period)	5.7	W/m²	0.5	W/ft²
Total end-use load (unocc. period)	2.4	W/m²	0.2	W/ft²
Usage during occupied period	100%			
Usage during unoccupied period	43%			

Computer Equipment	EUI	kWh/ft².yr	1.33
		MJ/m².yr	51.37
Plug Loads	EUI	kWh/ft².yr	1.74
		MJ/m².yr	67.29

FOOD SERVICE EQUIPMENT

Provide description below:

Commercial food services

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	1.8	EUI	kWh/ft².yr	0.1
	MJ/m².yr	70.0		MJ/m².yr	2.0

REFRIGERATION

Provide description below:

Walk-in coolers/freezers, reach-in coolers/freezers, refrigerated buffet cases

EUI	kWh/ft².yr	0.4
	MJ/m².yr	15.0

MISCELLANEOUS

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	6.5	EUI	kWh/ft².yr	0.0
	MJ/m².yr	250.0		MJ/m².yr	

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EXISTING BUILDINGS: Hospital Baseline | **SIZE:** 0 | **VINTAGE:** | **REGION:** Vancouver Island

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	10%	75%	8%	5%	0%	0%	0%	0%	2%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff. (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	19.3 W/m²	6.1 Btu/hr.ft²	
Seasonal Heating Load (Tertiary Load)	563 MJ/m².yr	14.5 kWh/ft².yr	
Sizing Factor	1.00		
Electric Fuel Share	2.0%	Fossil Fuel Share	98.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	14.5
MJ/m².yr	563

Gas EUI	
kWh/ft².yr	18.2
MJ/m².yr	705

Market Composite EUI	
kWh/ft².yr	18.1
MJ/m².yr	702

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7 °C	44.6 °F
Condenser Water	30 °C	86 °F
Supply Air	14.0 °C	57.2 °F

Peak Cooling Load	76 W/m²	24 Btu/hr.ft²	499 ft²/Ton
Seasonal Cooling Load (Tertiary Load)	131.0 MJ/m².yr	3.4 kWh/ft².yr	

Sizing Factor: 0.65 Operation (occ. period): 3000 hrs/year Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C): 90.0%

Electric Fuel Share: 100.0% Gas Fuel Share: 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenan

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	1.0
MJ/m².yr	38

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	1.0
MJ/m².yr	38

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	10%				80%
Eff./COP	0.65				0.80

	Fossil	Elec. Res.
Fuel Share	90%	10%
Blended Efficiency	0.78	0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load): 250.0

Wetting Use Percentage: 90%

All Electric EUI	
kWh/ft².yr	7.1
MJ/m².yr	275

Fossil Fuel EUI	
kWh/ft².yr	8.2
MJ/m².yr	319

Market Composite EUI	
kWh/ft².yr	8.1
MJ/m².yr	314.7

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Hospital	0		Vancouver Island
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	4.7	L/s.m²	0.93	CFM/ft²
System Static Pressure CAV	1500	Pa	6.0	wg
System Static Pressure VAV	1100	Pa	4.4	wg
Fan Efficiency	55%			
Fan Motor Efficiency	89%			
Sizing Factor	1.00			
Fan Design Load CAV	14.5	W/m²	1.35	W/ft²
Fan Design Load VAV	10.6	W/m²	0.99	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	50%	20%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	50%	50%	100%	0%
Comments:				

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m²	0.03	CFM/ft²
Other Exhaust (Smoking/Conference)	0.5	L/s.m²	0.10	CFM/ft²
Total Building Exhaust	0.6	L/s.m²	0.13	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.9	W/m²	0.08	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.013	kW/kW	0.05	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	0.99	W/m²	0.09	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.004	L/s.m²	0.006	U.S. gpm/ft²
Pump Head Pressure	100	kPa	33.333333	ft
Pump Efficiency	60%			
Pump Motor Efficiency	88%			
Sizing Factor	1.0			
Pump Connected Load	0.76	W/m²	0.07	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.003	L/s.m²	0.0048	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	60%					
Pump Motor Efficiency	88%					
Sizing Factor	0.8					
Pump Connected Load	0.5	W/m²	0.05	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	52.7	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	7.5	kWh/m².yr
Condenser Pump Energy Consumption	2.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.4	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	2.5	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI	kWh/ft².yr	6.1
	MJ/m².yr	234.6

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Hospital	**0**		**Vancouver Island**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES: **Electricity:** **18.1** kWh/ft².yr **702.1** MJ/m².yr **Fossil Fue** **33.5** kWh/ft².yr **1,297.7** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr	**END USE:**	Electricity kWh/ft².yr	Electricity MJ/m².yr	Fossil Fuel kWh/ft².yr	Fossil Fuel MJ/m².yr
GENERAL LIGHTING	4.8	187.2					
ARCHITECTURAL LIGHTING	0.7	27.4	SPACE HEATING	0.3	11.3	17.8	690.5
SPECIAL PURPOSE LIGHTING	0.0	0.0	SPACE COOLING	0.9	34.6	0.0	0.0
OTHER PLUG LOADS	1.7	67.3	DOMESTIC HOT WATER	0.7	27.5	7.4	287.2
HVAC FANS & PUMPS	6.1	234.6	FOOD SERVICE EQUIPMENT	0.1	2.0	1.8	70.0
REFRIGERATION	0.4	15.0	MISCELLANEOUS	0.0	0.0	6.5	250.0
COMPUTER EQUIPMENT	1.3	51.4					
ELEVATORS	0.3	11.6					
OUTDOOR LIGHTING	0.8	32.2					

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Nursing Home	50,000 to 100,000 ft²		Vancouver Island
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.61	W/m².°C	0.11	Btu/hr.ft² . °F
Roof U value (W/m².°C)	0.34	W/m².°C	0.06	Btu/hr.ft² . °F
Glazing U value (W/m².°C)	3.50	W/m².°C	0.62	Btu/hr.ft² . °F
Window/Wall Ratio (WIWAR) (%)	0.28			
Shading Coefficient (SC)	0.60			

Typical Building Size	8,364	m²	90,000	ft²
Typical Footprint (m²)	4,182	m²	45,000	ft²
Footprint Aspect Ratio (L:W)	7			
Percent Conditioned Space	100%			
Percent Conditioned Space Defined as Exterior Zone	45%			
Typical # Stories	2			
Floor to Floor Height (m)	3.7	m	12.0	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	90%		0%		10%	0%	0%		100%
Min. Air Flow (%)					60%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	30	m²/person	323	ft²/person
Occupancy Schedule Occ. Period	100%			
Occupancy Schedule Unocc. Period	95%			
Fresh Air Requirements or Outside Air	51	L/s.person	108	CFM/person

%OA 35.26%

Fresh Air Control Type *(enter a 1, 2 or 3) 1
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right: 15%
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation 0.5 L/s.m² 0.10 CFM/ft²
50% operation (%)

Sizing Factor	2			
Total Air Circulation or Design Air Flow	4.82	L/s.m²	0.95	CFM/ft²
Infiltration Rate	0.30	L/s.m²	0.06	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	3,778,320	
Peak Zone Sensible Load	918,427	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	42,725	
Total air circulation or Design air	4.82	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	23	°C	73.4	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	22	°C	71.6	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	22	°C	71.6	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning — Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Nursing Home	50,000 to 100,000 ft²		Vancouver Island
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	267	Lux	24.8	ft-candles
Floor Fraction (GLFF)	0.70			
Connected Load	6.9	W/m²	0.6	W/ft²
Occ. Period(Hrs./yr.)	3400			
Unocc. Period(Hrs./yr.)	5360			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	20%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	200	300	500	1000				Total
% Distribution	33%	67%	0%	0%				100%
Weighted Average								**267**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)					100.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	1.9
	MJ/m².yr	75

ARCHITECTURAL LIGHTING

Light Level	233	Lux	21.7	ft-candles
Floor Fraction (ALFF)	0.30			
Connected Load	18.6	W/m²	1.7	W/ft²
Occ. Period(Hrs./yr.)	3400			
Unocc. Period(Hrs./yr.)	5360			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	30%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	200	300	400	500				Total
% Distribution	67%	33%	0%	0%				100%
Weighted Average								**233**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	35%	65%						100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	2.5
	MJ/m².yr	97

SPECIAL PURPOSE LIGHTING

Light Level	0.00	Lux	0.0	ft-candles
Floor Fraction (HBLFF)	0.00			
Connected Load	0.0	W/m²	0.0	W/ft²
Occ. Period(Hrs./yr.)	4000			
Unocc. Period(Hrs./yr.)	4760			
Usage During Occupied Period	0%			
Usage During Unoccupied Period	100%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 | 1.00

Light Level (Lux)	300	500	700	1000				Total
% Distribution		0%	0%	0%				0%
Weighted Average								**0**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)								0.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	0.0
	MJ/m².yr	0

TOTAL LIGHTING

Overall LPD	10.41 W/m²	EUI TOTAL	kWh/ft².yr	4.4
	0.97 W/ft²		MJ/m².yr	172

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Servers		Plug Loads	
Measured Power (W/device)	55		51		100		200		217			
Density (device/occupant)	0.477744		0.477744		0.02		0.02		0.04			
Connected Load	0.9	W/m²	0.8	W/m²	0.1	W/m²	0.1	W/m²	0.5	W/m²	1.35	W/m²
	0.1	W/ft²	0.1	W/ft²	0.01	W/ft²	0.01	W/ft²	0.05	W/ft²	0.13	W/ft²
Diversity Occupied Period	90%		90%		90%		90%		100%		90%	
Diversity Unoccupied Period	50%		50%		50%		50%		100%		25%	
Operation Occ. Period (hrs./year)	2000		2000		2600		2600		2600		4100	
Operation Unocc. Period (hrs./year)	6760		6760		6160		6160		6160		4660	

Total end-use load (occupied period)	3.4	W/m²	0.3	W/ft²
Total end-use load (unocc. period)	1.8	W/m²	0.2	W/ft²
Usage during occupied period	100%			
Usage during unoccupied period	52%			

Computer Equipment	EUI	kWh/ft².yr	1.33
		MJ/m².yr	51.37
Plug Loads	EUI	kWh/ft².yr	0.61
		MJ/m².yr	23.60

FOOD SERVICE EQUIPMENT

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	1.5	EUI	kWh/ft².yr	1.3
	MJ/m².yr	60.0		MJ/m².yr	50.0

REFRIGERATION

Provide description below:

Walk-in coolers/freezers, reach-in coolers/freezers, refrigerated buffet cases

EUI	kWh/ft².yr	0.8
	MJ/m².yr	30.0

MISCELLANEOUS

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	1.8	EUI	kWh/ft².yr	0.0
	MJ/m².yr	70.0		MJ/m².yr	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: Nursing Home Baseline
SIZE: 50,000 to 100,000 ft²
VINTAGE:
REGION: Vancouver Island

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	10%	40%	10%	15%	15%	0%	5%	0%	5%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff.) (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	18.0	W/m²	5.7	Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	308	MJ/m².yr	8.0	kWh/ft².yr
Sizing Factor	1.00			
Electric Fuel Share	10.0%	Fossil Fuel Share	90.0%	

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	6.3
MJ/m².yr	245

Gas EUI	
kWh/ft².yr	10.0
MJ/m².yr	388

Market Composite EUI	
kWh/ft².yr	9.6
MJ/m².yr	373

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	0.0%	0.0%	0.0%	15.0%	85.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7	°C	44.6	°F
Condenser Water	30	°C	86	°F
Supply Air	14.0	°C	57.2	°F

Peak Cooling Load	112	W/m²	36	Btu/hr.ft²	336	ft²/Ton
Seasonal Cooling Load (Tertiary Load)	113.6	MJ/m².yr	2.9	kWh/ft².yr		

Sizing Factor 0.85 — Operation (occ. period) 3000 hrs/year — Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C) 30.0%

Electric Fuel Share 100.0% — Gas Fuel Share 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	1.3
MJ/m².yr	51

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	1.3
MJ/m².yr	51

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	25%				45%
Eff./COP	0.65				0.75

	Fossil	Elec. Res.
Fuel Share	70%	30%
Blended Efficiency	0.71	0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 170.0

Wetting Use Percentage 90%

All Electric EUI	
kWh/ft².yr	4.8
MJ/m².yr	187

Fossil Fuel EUI	
kWh/ft².yr	6.1
MJ/m².yr	238

Market Composite EUI	
kWh/ft².yr	5.7
MJ/m².yr	222.6

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EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Nursing Home	50,000 to 100,000 ft²		Vancouver Island
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	4.8	L/s.m²	0.95	CFM/ft²
System Static Pressure CAV	500	Pa	2.0	wg
System Static Pressure VAV	500	Pa	2.0	wg
Fan Efficiency	52%			
Fan Motor Efficiency	75%			
Sizing Factor	1.00			
Fan Design Load CAV	6.2	W/m²	0.57	W/ft²
Fan Design Load VAV	6.2	W/m²	0.57	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	90%	10%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	80%	20%	100%	0%
Comments:				

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.0	L/s.m²	0.01	CFM/ft²
Other Exhaust (Smoking/Conference)	0.5	L/s.m²	0.10	CFM/ft²
Total Building Exhaust	0.5	L/s.m²	0.11	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.7	W/m²	0.07	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.020	kW/kW	0.07	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	2.25	W/m²	0.21	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.006	L/s.m²	0.009	U.S. gpm/ft²
Pump Head Pressure	0	kPa	0	ft
Pump Efficiency	55%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.00	W/m²	0.00	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.005	L/s.m²	0.0071	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	55%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.9	W/m²	0.08	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	46.2	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	6.4	kWh/m².yr
Condenser Pump Energy Consumption	0.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.6	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	4.4	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI		
	kWh/ft².yr	5.4
	MJ/m².yr	207.5

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Nursing Home	**50,000 to 100,000 ft²**		**Vancouver Island**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**17.1**	kWh/ft².yr	**662.3**	MJ/m².yr	**Fossil Fue**	**16.7**	kWh/ft².yr	**645.5**	MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	1.9	74.8
ARCHITECTURAL LIGHTING	2.5	97.2
SPECIAL PURPOSE LIGHTING	0.0	0.0
OTHER PLUG LOADS	0.6	23.6
HVAC FANS & PUMPS	5.4	207.5
REFRIGERATION	0.8	30.0
COMPUTER EQUIPMENT	1.3	51.4
ELEVATORS	0.3	11.6
OUTDOOR LIGHTING	0.5	20.4

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.6	24.5	9.0	348.9
SPACE COOLING	0.4	15.4	0.0	0.0
DOMESTIC HOT WATER	1.4	56.0	4.3	166.6
FOOD SERVICE EQUIPMENT	1.3	50.0	1.5	60.0
MISCELLANEOUS	0.0	0.0	1.8	70.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Schools	> 50,000 ft2		Vancouver Island
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.57	W/m².°C	0.10	Btu/hr.ft² . °F
Roof U value (W/m².°C)	0.34	W/m².°C	0.06	Btu/hr.ft² . °F
Glazing U value (W/m².°C)	4.57	W/m².°C	0.80	Btu/hr.ft² . °F
Window/Wall Ratio (WIWAR) (%)	0.15			
Shading Coefficient (SC)	0.45			

Typical Building Size	9,300	m²	100,068	ft²
Typical Footprint (m²)	4,650	m²	50,034	ft²
Footprint Aspect Ratio (L:W)	5			
Percent Conditioned Space	100%			
Percent Conditioned Space Defined as Exterior Zone	37%			
Typical # Stories	2			
Floor to Floor Height (m)	4.0	m	13.2	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	80%		0%		20%		0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	10	m²/person	108	ft²/person
Occupancy Schedule Occ. Period	90%			
Occupancy Schedule Unocc. Period	0%			
Fresh Air Requirements or Outside Air	15	L/s.person	32	CFM/person

%OA 36.08%

Fresh Air Control Type *(enter a 1, 2 or 3) 1
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right:	34%			
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation	0.5	L/s.m²	0.10	CFM/ft²
	50%	operation (%)		

Sizing Factor	2			
Total Air Circulation or Design Air Flow	4.16	L/s.m²	0.82	CFM/ft²
Infiltration Rate	0.26	L/s.m²	0.05	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based	Total
Incidence of Use	0%		100%	100%
Switchover Point		KJ/kg.	18	°C
		Btu/lbm	64.4	°F

Summary of Design Parameters		
Peak Design Cooling Load	3,829,956	
Peak Zone Sensible Load	880,548	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	40,963	
Total air circulation or Design air	4.16	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	23	°C	73.4	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	19.5	°C	67.1	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Large Schools	**> 50,000 ft2**		**Vancouver Island**
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	450	Lux	41.8	ft-candles
Floor Fraction (GLFF)	0.89			
Connected Load	11.6	W/m²	1.1	W/ft²
Occ. Period(Hrs./yr.)	2500			
Unocc. Period(Hrs./yr.)	6260			
Usage During Occupied Period	85%			
Usage During Unoccupied Period	10%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	300	500	700	1000	Total
% Distribution	25%	75%	0%	0%	100%
Weighted Average					**450**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)					100.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	2.6
	MJ/m².yr	102

ARCHITECTURAL LIGHTING

Light Level	300	Lux	27.9	ft-candles
Floor Fraction (ALFF)	0.01			
Connected Load	19.3	W/m²	1.8	W/ft²
Occ. Period(Hrs./yr.)	3000			
Unocc. Period(Hrs./yr.)	5760			
Usage During Occupied Period	90%			
Usage During Unoccupied Period	75%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	300	500	700	1000	Total
% Distribution	100%	0%	0%	0%	100%
Weighted Average					**300**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	20%	80%						100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI	kWh/ft².yr	0.1
	MJ/m².yr	5

EUI = Load X Hrs. X SF X GLFF

SPECIAL PURPOSE LIGHTING

Light Level	300.00	Lux	27.9	ft-candles
Floor Fraction (HBLFF)	0.10			
Connected Load	14.0	W/m²	1.3	W/ft²
Occ. Period(Hrs./yr.)	3000			
Unocc. Period(Hrs./yr.)	5760			
Usage During Occupied Period	100%			
Usage During Unoccupied Period	0%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 | 1.00

Light Level (Lux)	300	500	700	1000	Total
% Distribution	100%	0%	0%	0%	100%
Weighted Average					**300**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)						100%		100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	0.4
	MJ/m².yr	15

TOTAL LIGHTING

Overall LPD	11.94 W/m²	EUI TOTAL	kWh/ft².yr	3.2
	1.11 W/ft²		MJ/m².yr	122

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Servers	Plug Loads
Measured Power (W/device)	55	51	100	200	217	
Density (device/occupant)	0.222732	0.222732	0.02	0.02	0.01	
Connected Load	1.2 W/m²	1.1 W/m²	0.2 W/m²	0.4 W/m²	0.5 W/m²	0.1 W/m²
	0.1 W/ft²	0.1 W/ft²	0.02 W/ft²	0.04 W/ft²	0.05 W/ft²	0.01 W/ft²
Diversity Occupied Period	90%	90%	90%	90%	100%	100%
Diversity Unoccupied Period	25%	25%	25%	25%	100%	0%
Operation Occ. Period (hrs./year)	2000	2000	2000	2000	2600	3000
Operation Unocc. Period (hrs./year)	6760	6760	6760	6760	6160	5760

Total end-use load (occupied period)	3.3 W/m²	0.3 W/ft²
Total end-use load (unocc. period)	1.3 W/m²	0.1 W/ft²
Usage during occupied period	100%	
Usage during unoccupied period	38%	

Computer Equipment	EUI	kWh/ft².yr	1.37
		MJ/m².yr	53.21
Plug Loads	EUI	kWh/ft².yr	0.03
		MJ/m².yr	1.08

FOOD SERVICE EQUIPMENT

Provide description below:

Cafeteria

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	0.5	EUI	kWh/ft².yr	0.1
	MJ/m².yr	20.0		MJ/m².yr	2.1

REFRIGERATION

Provide description below:

Unknown

EUI	kWh/ft².yr	0.1
	MJ/m².yr	2.1

MISCELLANEOUS

Provide description below:

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	0.1	EUI	kWh/ft².yr	0.0
	MJ/m².yr	5.0		MJ/m².yr	1.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Schools	> 50,000 ft2		Vancouver Island
Baseline			

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	10%	60%	10%	5%	0%	0%	3%	10%	2%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff. (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	16.5 W/m²	5.2 Btu/hr.ft²	
Seasonal Heating Load (Tertiary Load)	265 MJ/m².yr	6.9 kWh/ft².yr	
Sizing Factor	1.00		
Electric Fuel Share	15.0%	Fossil Fuel Share	85.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	3.2
MJ/m².yr	126

Gas EUI	
kWh/ft².yr	8.6
MJ/m².yr	331

Market Composite EUI	
kWh/ft².yr	7.8
MJ/m².yr	300

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7 °C	44.6 °F
Condenser Water	30 °C	86 °F
Supply Air	14.0 °C	57.2 °F

Peak Cooling Load	121 W/m²	38 Btu/hr.ft²	314 ft²/Ton
Seasonal Cooling Load (Tertiary Load)	95.4 MJ/m².yr	2.5 kWh/ft².yr	

Sizing Factor 1.00 — Operation (occ. period) 3000 hrs/year Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C) 20.0%

Electric Fuel Share 100.0% — Gas Fuel Share 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	1.1
MJ/m².yr	41

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	1.1
MJ/m².yr	41

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank					Boiler
System Present (%)	65%					25%
Eff./COP	0.65					0.75

	Fossil	Elec. Res.
Fuel Share	90%	10%
Blended Efficiency	0.68	0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 35.0

Wetting Use Percentage 90%

All Electric EUI	
kWh/ft².yr	1.0
MJ/m².yr	38

Fossil Fuel EUI	
kWh/ft².yr	1.3
MJ/m².yr	52

Market Composite EUI	
kWh/ft².yr	1.3
MJ/m².yr	50.3

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Large Schools	**> 50,000 ft2**		**Vancouver Island**
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	4.2	L/s.m²	0.82	CFM/ft²
System Static Pressure CAV	500	Pa	2.0	wg
System Static Pressure VAV	500	Pa	2.0	wg
Fan Efficiency	60%			
Fan Motor Efficiency	88%			
Sizing Factor	1.00			
Fan Design Load CAV	3.9	W/m²	0.37	W/ft²
Fan Design Load VAV	3.9	W/m²	0.37	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	80%	20%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	50%	50%	50%	50%
Comments:				

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.0	L/s.m²	0.01	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.1	L/s.m²	0.03	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.2	W/m²	0.02	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.027	kW/kW	0.09	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	3.26	W/m²	0.30	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.006	L/s.m²	0.009	U.S. gpm/ft²
Pump Head Pressure	45	kPa	15	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.72	W/m²	0.07	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.005	L/s.m²	0.0077	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	1.0	W/m²	0.10	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	22.4	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	1.2	kWh/m².yr
Condenser Pump Energy Consumption	1.6	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.7	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	5.2	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI	kWh/ft².yr	2.9
	MJ/m².yr	111.6

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Large Schools	**> 50,000 ft2**		**Vancouver Island**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**8.9**	kWh/ft².yr	**346.2**	MJ/m².yr	**Fossil Fue**	**9.1**	kWh/ft².yr	**353.1**	MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr	**END USE:**	Electricity		Fossil Fuel	
				kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	2.6	102.5					
ARCHITECTURAL LIGHTING	0.1	4.9	SPACE HEATING	0.5	18.8	7.3	281.7
SPECIAL PURPOSE LIGHTING	0.4	15.1	SPACE COOLING	0.2	8.2	0.0	0.0
OTHER PLUG LOADS	0.0	1.1	DOMESTIC HOT WATER	0.1	3.8	1.2	46.5
HVAC FANS & PUMPS	2.9	111.6	FOOD SERVICE EQUIPMENT	0.1	2.1	0.5	20.0
REFRIGERATION	0.1	2.1	MISCELLANEOUS	0.0	1.0	0.1	5.0
COMPUTER EQUIPMENT	1.4	53.2					
ELEVATORS	0.3	11.6					
OUTDOOR LIGHTING	0.3	10.2					

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Schools	< 50,000 ft2		Vancouver Island
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.57	W/m².°C	0.10	Btu/hr.ft² . °F
Roof U value (W/m².°C)	0.34	W/m².°C	0.06	Btu/hr.ft² . °F
Glazing U value (W/m².°C)	3.50	W/m².°C	0.62	Btu/hr.ft² . °F
Window/Wall Ratio (WIWAR) (%)	0.15			
Shading Coefficient (SC)	0.45			

Typical Building Size	2,300	m²	24,748	ft²
Typical Footprint (m²)	2,300	m²	24,748	ft²
Footprint Aspect Ratio (L:W)	5			
Percent Conditioned Space	100%			
Percent Conditioned Space Defined as Exterior Zone	50%			
Typical # Stories	1			
Floor to Floor Height (m)	4.0	m	13.2	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	90%		0%		10%		0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	10	m²/person	108	ft²/person
Occupancy Schedule Occ. Period	90%			
Occupancy Schedule Unocc. Period	0%			
Fresh Air Requirements or Outside Air	8	L/s.person	16	CFM/person

%OA 29.51%

Fresh Air Control Type *(enter a 1, 2 or 3) 1
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right: 34%
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation 0.5 L/s.m² 0.10 CFM/ft²; 50% operation (%)

Sizing Factor	1.2			
Total Air Circulation or Design Air Flow	2.54	L/s.m²	0.50	CFM/ft²
Infiltration Rate	0.26	L/s.m²	0.05	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based	Dry-Bulb Based	Total
Incidence of Use	0%	100%	100%
Switchover Point	KJ/kg.	18 °C	
	Btu/lbm	64.4 °F	

Summary of Design Parameters		
Peak Design Cooling Load	612,953	
Peak Zone Sensible Load	221,849	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	10,320	
Total air circulation or Design air	2.54	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	21	°C	69.8	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	20.4	°C	68.72	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Schools	< 50,000 ft2		Vancouver Island
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	400	Lux	37.2	ft-candles
Floor Fraction (GLFF)	0.89			
Connected Load	10.3	W/m²	1.0	W/ft²
Occ. Period(Hrs./yr.)	2400			
Unocc. Period(Hrs./yr.)	6360			
Usage During Occupied Period	85%			
Usage During Unoccupied Period	25%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	300	500	700	1000			Total
% Distribution	50%	50%	0%	0%			100%
Weighted Average							**400**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			0.0%		100.0%			100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	3.1
	MJ/m².yr	120

ARCHITECTURAL LIGHTING

Light Level	400	Lux	37.2	ft-candles
Floor Fraction (ALFF)	0.01			
Connected Load	25.8	W/m²	2.4	W/ft²
Occ. Period(Hrs./yr.)	2400			
Unocc. Period(Hrs./yr.)	6360			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	30%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	300	500	700	1000			Total
% Distribution	50%	50%	0%	0%			100%
Weighted Average							**400**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	20%	80%						100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	0.1
	MJ/m².yr	4

SPECIAL PURPOSE LIGHTING

Light Level	300.00	Lux	27.9	ft-candles
Floor Fraction (HBLFF)	0.10			
Connected Load	14.0	W/m²	1.3	W/ft²
Occ. Period(Hrs./yr.)	2500			
Unocc. Period(Hrs./yr.)	6260			
Usage During Occupied Period	100%			
Usage During Unoccupied Period	0%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 | 1.00

Light Level (Lux)	300	500	700	1000			Total
% Distribution	100%	0%	0%	0%			100%
Weighted Average							**300**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)						100%		100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	0.3
	MJ/m².yr	13

TOTAL LIGHTING

Overall LPD	9.45 W/m²	EUI TOTAL	kWh/ft².yr	3.5
	0.88 W/ft²		MJ/m².yr	137

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Servers		Plug Loads	
Measured Power (W/device)	55		51		100		200		217			
Density (device/occupant)	0.05		0.05		0.02		0.02		0.01			
Connected Load	0.3	W/m²	0.3	W/m²	0.2	W/m²	0.4	W/m²	0.5	W/m²	0.2	W/m²
	0.0	W/ft²	0.0	W/ft²	0.02	W/ft²	0.04	W/ft²	0.05	W/ft²	0.02	W/ft²
Diversity Occupied Period	90%		90%		90%		90%		100%		100%	
Diversity Unoccupied Period	25%		25%		25%		25%		100%		0%	
Operation Occ. Period (hrs./year)	2900		2900		2600		2600		2600		3000	
Operation Unocc. Period (hrs./year)	5860		5860		6160		6160		6160		5760	

Total end-use load (occupied period)	1.7	W/m²	0.2	W/ft²
Total end-use load (unocc. period)	0.8	W/m²	0.1	W/ft²
Usage during occupied period	100%			
Usage during unoccupied period	46%			

Computer Equipment	EUI	kWh/ft².yr	0.83
		MJ/m².yr	32.30
Plug Loads	EUI	kWh/ft².yr	0.06
		MJ/m².yr	2.16

FOOD SERVICE EQUIPMENT

Provide description below:

Cafeteria

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	0.1	EUI	kWh/ft².yr	0.1
	MJ/m².yr	5.0		MJ/m².yr	2.5

REFRIGERATION

Provide description below:

Unknown

EUI	kWh/ft².yr	0.1
	MJ/m².yr	3.0

MISCELLANEOUS

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	0.1	EUI	kWh/ft².yr	0.1
	MJ/m².yr	5.0		MJ/m².yr	5.0

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Medium Schools	**< 50,000 ft2**		**Vancouver Island**
Baseline			

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	10%	60%	14%	5%	0%	0%	0%	10%	1%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff. (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	23.0 W/m²	7.3	Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	225 MJ/m².yr	5.8	kWh/ft².yr
Sizing Factor	1.00		
Electric Fuel Share	11.0%	Fossil Fuel Share	89.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	2.3
MJ/m².yr	89

Gas EUI	
kWh/ft².yr	7.2
MJ/m².yr	280

Market Composite EUI	
kWh/ft².yr	6.7
MJ/m².yr	259

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7	°C	44.6	°F
Condenser Water	30	°C	86	°F
Supply Air	14.0	°C	57.2	°F

Peak Cooling Load	78 W/m²	25 Btu/hr.ft²	485 ft²/Ton
Seasonal Cooling Load (Tertiary Load)	85.2 MJ/m².yr	2.2 kWh/ft².yr	

Sizing Factor: 1.00 — Operation (occ. period) 3000 hrs/year Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C): 10.0%

Electric Fuel Share: 100.0% — Gas Fuel Share: 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenan

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	1.0
MJ/m².yr	37

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	1.0
MJ/m².yr	37

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	75%				10%
Eff./COP	0.65				0.75

	Fossil		Elec. Res.
Fuel Share	85%		15%
Blended Efficiency	0.66		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load): 35.0

Wetting Use Percentage: 90%

All Electric EUI	
kWh/ft².yr	1.0
MJ/m².yr	38

Fossil Fuel EUI	
kWh/ft².yr	1.4
MJ/m².yr	53

Market Composite EUI	
kWh/ft².yr	1.3
MJ/m².yr	50.7

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Schools	< 50,000 ft2		Vancouver Island
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	2.5	L/s.m²	0.50	CFM/ft²
System Static Pressure CAV	250	Pa	1.0	wg
System Static Pressure VAV	250	Pa	1.0	wg
Fan Efficiency	60%			
Fan Motor Efficiency	88%			
Sizing Factor	1.00			
Fan Design Load CAV	1.2	W/m²	0.11	W/ft²
Fan Design Load VAV	1.2	W/m²	0.11	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	90%	10%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	50%	50%	50%	50%
Comments:				

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m²	0.02	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.2	L/s.m²	0.04	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.2	W/m²	0.02	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.027	kW/kW	0.09	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	2.11	W/m²	0.20	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.004	L/s.m²	0.006	U.S. gpm/ft²
Pump Head Pressure	45	kPa	15	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.47	W/m²	0.04	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.003	L/s.m²	0.0050	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.7	W/m²	0.06	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	7.1	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	1.5	kWh/m².yr
Condenser Pump Energy Consumption	1.2	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.6	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	3.4	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI	kWh/ft².yr	1.3
	MJ/m².yr	49.8

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Schools	< 50,000 ft2		Vancouver Island
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	Electricity:	7.0	kWh/ft².yr	272.4	MJ/m².yr	Fossil Fue	7.8	kWh/ft².yr	303.8	MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	3.1	120.2
ARCHITECTURAL LIGHTING	0.1	3.9
SPECIAL PURPOSE LIGHTING	0.3	12.6
OTHER PLUG LOADS	0.1	2.2
HVAC FANS & PUMPS	1.3	49.8
REFRIGERATION	0.1	3.0
COMPUTER EQUIPMENT	0.8	32.3
ELEVATORS	0.3	11.6
OUTDOOR LIGHTING	0.3	10.2

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.3	9.8	6.4	248.8
SPACE COOLING	0.1	3.7	0.0	0.0
DOMESTIC HOT WATER	0.1	5.8	1.2	45.0
FOOD SERVICE EQUIPMENT	0.1	2.5	0.1	5.0
MISCELLANEOUS	0.1	5.0	0.1	5.0

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
University-Colleges	0		Vancouver Island
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.68	W/m².°C	0.12	Btu/hr.ft² . °F	Typical Building Size	9,000	m²	96,840	ft²
Roof U value (W/m².°C)	0.34	W/m².°C	0.06	Btu/hr.ft² . °F	Typical Footprint (m²)	3,000	m²	32,280	ft²
Glazing U value (W/m².°C)	3.50	W/m².°C	0.62	Btu/hr.ft² . °F	Footprint Aspect Ratio (L:W)	7			
					Percent Conditioned Space	100%			
					Percent Conditioned Space Defined as Exterior Zone	50%			
Window/Wall Ratio (WIWAR) (%)	0.30								
Shading Coefficient (SC)	0.45				Typical # Stories	3			
					Floor to Floor Height (m)	3.7	m	12.0	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	50%		0%		50%		0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	14	m²/person	151	ft²/person	%OA	32.98%
Occupancy Schedule Occ. Period	90%					
Occupancy Schedule Unocc. Period	0%					
Fresh Air Requirements or Outside Air	20	L/s.person	42	CFM/person		

Fresh Air Control Type *(enter a 1, 2 or 3)	1	If Fresh Air Control Type = "2" enter % FA. to the right:	34%		
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)		If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation	0.5 L/s.m²	0.10	CFM/ft²
			50% operation (%)		

Sizing Factor	1.65			
Total Air Circulation or Design Air Flow	4.33	L/s.m²	0.85	CFM/ft²
Infiltration Rate	0.26	L/s.m²	0.05	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	3,745,176	
Peak Zone Sensible Load	1,076,006	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	50,056	
Total air circulation or Design air	4.33	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	24	°C	75.2	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	20.4	°C	68.72	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning — Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
University-Colleges	0		Vancouver Island
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	480	Lux	44.6	ft-candles
Floor Fraction (GLFF)	0.93			
Connected Load	12.4	W/m²	1.2	W/ft²

Occ. Period(Hrs./yr.)	4100	
Unocc. Period(Hrs./yr.)	4660	
Usage During Occupied Period	90%	
Usage During Unoccupied Period	20%	
Fixture Cleaning:		
Incidence of Practice		
Interval		years
Relamping Strategy & Incidence of Practice	Group	Spot

Light Level (Lux)	300	500	700	1000				Total
% Distribution	10%	90%	0%	0%				100%
Weighted Average								**480**
	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)					100.0%			100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	5.0
	MJ/m².yr	192

ARCHITECTURAL LIGHTING

Light Level	300	Lux	27.9	ft-candles
Floor Fraction (ALFF)	0.02			
Connected Load	20.9	W/m²	1.9	W/ft²

Occ. Period(Hrs./yr.)	4100	
Unocc. Period(Hrs./yr.)	4660	
Usage During Occupied Period	100%	
Usage During Unoccupied Period	100%	
Fixture Cleaning:		
Incidence of Practice		
Interval		years
Relamping Strategy & Incidence of Practice	Group	Spot

Light Level (Lux)	300	500	700	1000				Total
% Distribution	100%	0%	0%	0%				100%
Weighted Average								**300**
	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	25%	75%						100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	0.3
	MJ/m².yr	13

SPECIAL PURPOSE LIGHTING

Light Level	500.00	Lux	46.5	ft-candles
Floor Fraction (HBLFF)	0.05			
Connected Load	18.9	W/m²	1.8	W/ft²

Floor fraction check: should = 1.00 — 1.00

Occ. Period(Hrs./yr.)	4100	
Unocc. Period(Hrs./yr.)	4660	
Usage During Occupied Period	90%	
Usage During Unoccupied Period	20%	
Fixture Cleaning:		
Incidence of Practice		
Interval		years
Relamping Strategy & Incidence of Practice	Group	Spot

Light Level (Lux)	300	500	700	1000				Total
% Distribution	0%	100%	0%	0%				100%
Weighted Average								**500**
	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)						100%		100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.7	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	0.4
	MJ/m².yr	16

TOTAL LIGHTING

Overall LPD	11.95 W/m²	EUI TOTAL	kWh/ft².yr	5.7
	1.11 W/ft²		MJ/m².yr	221

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Servers		Plug Loads	
Measured Power (W/device)	55		51		100		200		217			
Density (device/occupant)	0.311825		0.311825		0.02		0.02		0.01			
Connected Load	1.2	W/m²	1.1	W/m²	0.1	W/m²	0.3	W/m²	0.5	W/m²	1.3	W/m²
	0.1	W/ft²	0.1	W/ft²	0.01	W/ft²	0.03	W/ft²	0.05	W/ft²	0.12	W/ft²
Diversity Occupied Period	90%		90%		90%		90%		100%		100%	
Diversity Unoccupied Period	50%		50%		50%		50%		100%		20%	
Operation Occ. Period (hrs./year)	2000		2000		2600		2600		2600		2000	
Operation Unocc. Period (hrs./year)	6760		6760		6160		6160		6160		6760	

Total end-use load (occupied period)	4.3	W/m²	0.4	W/ft²
Total end-use load (unocc. period)	2.2	W/m²	0.2	W/ft²
Usage during occupied period	100%			
Usage during unoccupied period	50%			

Computer Equipment	EUI	kWh/ft².yr	1.76
		MJ/m².yr	68.30
Plug Loads	EUI	kWh/ft².yr	0.40
		MJ/m².yr	15.69

FOOD SERVICE EQUIPMENT

Provide description below:

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	0.8	EUI	kWh/ft².yr	0.3
	MJ/m².yr	30.0		MJ/m².yr	10.0

REFRIGERATION

Provide description below:

Unknown

EUI	kWh/ft².yr	0.5
	MJ/m².yr	20.0

MISCELLANEOUS

Provide description below:

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	1.0	EUI	kWh/ft².yr	0.0
	MJ/m².yr	40.0		MJ/m².yr	0.0

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
University-Colleges	0		Vancouver Island
Baseline			

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	10%	49%	25%	10%	0%	0%	2%	1%	2%	0%	99%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff. (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	21.3	W/m²	6.7	Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	304	MJ/m².yr	7.8	kWh/ft².yr
Sizing Factor	1.00			

Electric Fuel Share 5.0% Fossil Fuel Share 95.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	5.5
MJ/m².yr	213

Gas EUI	
kWh/ft².yr	9.7
MJ/m².yr	374

Market Composite EUI	
kWh/ft².yr	9.4
MJ/m².yr	362

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	0.0%	25.0%	0.0%	0.0%	75.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7	°C	44.6	°F
Condenser Water	30	°C	86	°F
Supply Air	14.0	°C	57.2	°F

Peak Cooling Load	122	W/m²	39	Btu/hr.ft²	310	ft²/Ton
Seasonal Cooling Load (Tertiary Load)	121.5	MJ/m².yr	3.1	kWh/ft².yr		

Sizing Factor 1.00 Operation (occ. period) 3000 hrs/year Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C) 20.0%

Electric Fuel Share 100.0% Gas Fuel Share 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenan

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	1.4
MJ/m².yr	54

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	1.4
MJ/m².yr	54

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	10%				80%
Eff./COP	0.65				0.75

	Fossil	Elec. Res.
Fuel Share	90%	10%
Blended Efficiency	0.74	0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 60.0

Wetting Use Percentage 90%

All Electric EUI	
kWh/ft².yr	1.7
MJ/m².yr	66

Fossil Fuel EUI	
kWh/ft².yr	2.1
MJ/m².yr	81

Market Composite EUI	
kWh/ft².yr	2.1
MJ/m².yr	79.7

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
University-Colleges	0		Vancouver Island
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	4.3	L/s.m²	0.85	CFM/ft²
System Static Pressure CAV	950	Pa	3.8	wg
System Static Pressure VAV	950	Pa	3.8	wg
Fan Efficiency	60%			
Fan Motor Efficiency	80%			
Sizing Factor	1.00			
Fan Design Load CAV	8.6	W/m²	0.80	W/ft²
Fan Design Load VAV	8.6	W/m²	0.80	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	50%	50%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	50%	50%	100%	0%

Comments:

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m²	0.01	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.2	L/s.m²	0.03	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.2	W/m²	0.02	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.027	kW/kW	0.09	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	3.29	W/m²	0.31	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.006	L/s.m²	0.010	U.S. gpm/ft²
Pump Head Pressure	0	kPa	0	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.00	W/m²	0.00	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.005	L/s.m²	0.0077	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	1.1	W/m²	0.10	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	43.0	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	1.9	kWh/m².yr
Condenser Pump Energy Consumption	0.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.9	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	5.3	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI		
	kWh/ft².yr	4.7
	MJ/m².yr	183.8

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
University-Colleges	0		Vancouver Island
Baseline			

EUI SUMMARY

TOTAL ALL END-USES: **Electricity:** **14.8** kWh/ft².yr **575.1** MJ/m².yr **Fossil Fue** **12.9** kWh/ft².yr **498.5** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	5.0	191.8
ARCHITECTURAL LIGHTING	0.3	13.2
SPECIAL PURPOSE LIGHTING	0.4	15.7
OTHER PLUG LOADS	0.4	15.7
HVAC FANS & PUMPS	4.7	183.8
REFRIGERATION	0.5	20.0
COMPUTER EQUIPMENT	1.8	68.3
ELEVATORS	0.3	11.6
OUTDOOR LIGHTING	0.4	17.0

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.3	10.7	9.2	355.4
SPACE COOLING	0.3	10.8	0.0	0.0
DOMESTIC HOT WATER	0.2	6.6	1.9	73.1
FOOD SERVICE EQUIPMENT	0.3	10.0	0.8	30.0
MISCELLANEOUS	0.0	0.0	1.0	40.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Restaurant	**0**		**Vancouver Island**
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.62	W/m².°C	0.11	Btu/hr.ft² . °F	Typical Building Size	781	m²	8,400	ft²
Roof U value (W/m².°C)	0.32	W/m².°C	0.06	Btu/hr.ft² . °F	Typical Footprint (m²)	781	m²	8,400	ft²
Glazing U value (W/m².°C)	3.50	W/m².°C	0.62	Btu/hr.ft² . °F	Footprint Aspect Ratio (L:W)	1			
					Percent Conditioned Space	100%			
					Percent Conditioned Space Defined as Exterior Zone	45%			
Window/Wall Ratio (WIWAR) (%)	0.18								
Shading Coefficient (SC)	0.69				Typical # Stories	1			
					Floor to Floor Height (m)	3.8	m	12.5	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	100%		0%		0%		0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	20	m²/person	215	ft²/person	%OA	31.32%
Occupancy Schedule Occ. Period	90%					
Occupancy Schedule Unocc. Period	0%					
Fresh Air Requirements or Outside Air	30	L/s.person	64	CFM/person		

Fresh Air Control Type *(enter a 1, 2 or 3)	1	If Fresh Air Control Type = "2" enter % FA. to the right:	0%			
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)		If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation	0.5	L/s.m²	0.10	CFM/ft²
			50%	operation (%)		

Sizing Factor	1.5			
Total Air Circulation or Design Air Flow	4.79	L/s.m²	0.94	CFM/ft²
Infiltration Rate	0.70	L/s.m²	0.14	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	352,151	
Peak Zone Sensible Load	113,527	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R.	13.2	ft³/lbm
Design CFM	5,281	
Total air circulation or Design air	4.79	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	22	°C	71.6	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	21	°C	69.8	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning — Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Restaurant	0		Vancouver Island
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	400	Lux	37.1	ft-candles
Floor Fraction (GLFF)	0.30			
Connected Load	10.3	W/m²	1.0	W/ft²
Occ. Period(Hrs./yr.)	4100			
Unocc. Period(Hrs./yr.)	4660			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	30%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	300	400	500	1000	Total
% Distribution	33%	33%	33%	0%	100%
Weighted Average					**399.6**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)					100.0%			100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	1.5
	MJ/m².yr	59

ARCHITECTURAL LIGHTING

Light Level	280	Lux	26.0	ft-candles
Floor Fraction (ALFF)	0.70			
Connected Load	29.5	W/m²	2.7	W/ft²
Occ. Period(Hrs./yr.)	4100			
Unocc. Period(Hrs./yr.)	4660			
Usage During Occupied Period	80%			
Usage During Unoccupied Period	30%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	100	200	300	400	Total
% Distribution	10%	30%	30%	30%	100%
Weighted Average					**280**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	60%	40%						100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	9.0
	MJ/m².yr	348

SPECIAL PURPOSE LIGHTING

Light Level	0.00	Lux	0.0	ft-candles
Floor Fraction (HBLFF)	0.00			
Connected Load	0.0	W/m²	0.0	W/ft²
Occ. Period(Hrs./yr.)	4000			
Unocc. Period(Hrs./yr.)	4760			
Usage During Occupied Period	0%			
Usage During Unoccupied Period	100%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 | 1.00

Light Level (Lux)	300	500	700	1000	Total
% Distribution		0%	0%	0%	0%
Weighted Average					**0**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)								0.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	0.0
	MJ/m².yr	0

TOTAL LIGHTING

Overall LPD	23.77 W/m²	EUI TOTAL	kWh/ft².yr	10.5
	2.21 W/ft²		MJ/m².yr	407

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Servers	Plug Loads
Measured Power (W/device)	55	51	100	200	217	
Density (device/occupant)	0.1614	0.1614	0.01	0.01	0.01	
Connected Load	0.4 W/m²	0.4 W/m²	0.1 W/m²	0.1 W/m²	0.5 W/m²	3.2 W/m²
	0.0 W/ft²	0.0 W/ft²	0.00 W/ft²	0.01 W/ft²	0.05 W/ft²	0.30 W/ft²
Diversity Occupied Period	90%	90%	90%	90%	100%	90%
Diversity Unoccupied Period	50%	50%	50%	50%	100%	90%
Operation Occ. Period (hrs./year)	2000	2000	2600	2600	2600	4100
Operation Unocc. Period (hrs./year)	6760	6760	6160	6160	6160	4660

Total end-use load (occupied period)	4.3 W/m²	0.4 W/ft²
Total end-use load (unocc. period)	3.9 W/m²	0.4 W/ft²
Usage during occupied period	100%	
Usage during unoccupied period	91%	

Computer Equipment	EUI	kWh/ft².yr	0.90
		MJ/m².yr	34.97
Plug Loads	EUI	kWh/ft².yr	2.34
		MJ/m².yr	90.82

FOOD SERVICE EQUIPMENT

Provide description below:

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	23.2	EUI	kWh/ft².yr	8.6
	MJ/m².yr	900.0		MJ/m².yr	333.0

REFRIGERATION

Provide description below:

EUI	kWh/ft².yr	16.8
	MJ/m².yr	650.0

MISCELLANEOUS

Provide description below:

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	0.8	EUI	kWh/ft².yr	2.3
	MJ/m².yr	30.0		MJ/m².yr	90.0

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Restaurant	0		Vancouver Island
Baseline			

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	1%	2%	1%	59%	30%	0%	2%	0%	5%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff. (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	25.6	W/m²	8.1	Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	242	MJ/m².yr	6.2	kWh/ft².yr
Sizing Factor	1.00			
Electric Fuel Share	7.0%	Fossil Fuel Share	93.0%	

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	kWh/ft².yr	5.5
	MJ/m².yr	214
Gas EUI	kWh/ft².yr	8.1
	MJ/m².yr	315
Market Composite EUI	kWh/ft².yr	8.0
	MJ/m².yr	308

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	0.0%	0.0%	0.0%	10.0%	90.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7	°C	44.6	°F
Condenser Water	30	°C	86	°F
Supply Air	14.0	°C	57.2	°F

Peak Cooling Load	159	W/m²	50	Btu/hr.ft²	239	ft²/Ton
Seasonal Cooling Load (Tertiary Load)	164.6	MJ/m².yr	4.2	kWh/ft².yr		

Sizing Factor 1.20 — Operation (occ. period) 3000 hrs/year — Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C) 70.0%

Electric Fuel Share 100.0% — Gas Fuel Share 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenan

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	kWh/ft².yr	2.0
	MJ/m².yr	76
Natural Gas EUI	kWh/ft².yr	0.0
	MJ/m².yr	0
Market Composite EUI	kWh/ft².yr	2.0
	MJ/m².yr	76

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Avg. Tank				Boiler
System Present (%)	65%				10%
Eff./COP	0.65				0.75

	Fossil	Elec. Res.
Fuel Share	75%	25%
Blended Efficiency	0.66	0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 600.0

Wetting Use Percentage 10%

	All Electric EUI	Fossil Fuel EUI	Market Composite EUI
kWh/ft².yr	17.0	23.4	21.8
MJ/m².yr	659	905	843.2

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EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Restaurant	0		Vancouver Island
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	4.8	L/s.m²	0.94	CFM/ft²
System Static Pressure CAV	500	Pa	2.0	wg
System Static Pressure VAV	500	Pa	2.0	wg
Fan Efficiency	60%			
Fan Motor Efficiency	80%			
Sizing Factor	1.00			
Fan Design Load CAV	5.0	W/m²	0.46	W/ft²
Fan Design Load VAV	5.0	W/m²	0.46	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	100%	0%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	80%	20%	100%	0%
Comments:				

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.3	L/s.m²	0.05	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.4	L/s.m²	0.07	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.5	W/m²	0.04	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.020	kW/kW	0.07	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	3.17	W/m²	0.29	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.008	L/s.m²	0.012	U.S. gpm/ft²
Pump Head Pressure	0	kPa	0	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.00	W/m²	0.00	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.007	L/s.m²	0.0101	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	0	kPa	0	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.0	W/m²	0.00	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	38.5	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	4.2	kWh/m².yr
Condenser Pump Energy Consumption	0.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.9	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	0.0	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI		
	kWh/ft².yr	4.0
	MJ/m².yr	156.6

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Restaurant	0		Vancouver Island
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	Electricity:	55.6	kWh/ft².yr	2,152.9	MJ/m².yr	Fossil Fuel	49.1	kWh/ft².yr	1,901.6	MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	1.5	59.0
ARCHITECTURAL LIGHTING	9.0	348.2
SPECIAL PURPOSE LIGHTING	0.0	0.0
OTHER PLUG LOADS	2.3	90.8
HVAC FANS & PUMPS	4.0	156.6
REFRIGERATION	16.8	650.0
COMPUTER EQUIPMENT	0.9	35.0
ELEVATORS	0.3	11.6
OUTDOOR LIGHTING	3.8	145.9

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.4	15.0	7.6	293.2
SPACE COOLING	1.4	52.9	0.0	0.0
DOMESTIC HOT WATER	4.3	164.8	17.5	678.4
FOOD SERVICE EQUIPMENT	8.6	333.0	23.2	900.0
MISCELLANEOUS	2.3	90.0	0.8	30.0

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Warehouse/Whsale	**0**		**Vancouver Island**
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.45	W/m².°C	0.08	Btu/hr.ft² . °F	Typical Building Size	3,200 m²	34,432	ft²
Roof U value (W/m².°C)	0.32	W/m².°C	0.06	Btu/hr.ft² . °F	Typical Footprint (m²)	3,200 m²	34,432	ft²
Glazing U value (W/m².°C)	3.50	W/m².°C	0.62	Btu/hr.ft² . °F	Footprint Aspect Ratio (L:W)	1		
					Percent Conditioned Space	100%		
					Percent Conditioned Space Defined as Exterior Zone	40%		
Window/Wall Ratio (WIWAR) (%)	0.05							
Shading Coefficient (SC)	0.80				Typical # Stories	1		
					Floor to Floor Height (m)	6.1 m	19.9	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	100%		0%		0%		0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	100	m²/person	1076	ft²/person	%OA 24.78%
Occupancy Schedule Occ. Period	90%				
Occupancy Schedule Unocc. Period	0%				
Fresh Air Requirements or Outside Air	30	L/s.person	64	CFM/person	

Fresh Air Control Type *(enter a 1, 2 or 3) | 1 | If Fresh Air Control Type = "2" enter % FA. to the right: | 0%
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air) | If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation | 0.5 L/s.m² | 0.10 CFM/ft²
50% operation (%)

Sizing Factor	1			
Total Air Circulation or Design Air Flow	1.21	L/s.m²	0.24	CFM/ft²
Infiltration Rate	0.38	L/s.m²	0.07	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	372,080	
Peak Zone Sensible Load	176,454	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	8,209	
Total air circulation or Design air	1.21	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	22	°C	71.6	°F	13	°C	55.4	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	16	°C	60.8	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	20.25	°C	68.45	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning — Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Warehouse/Whsale	0		Vancouver Island
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	400	Lux	37.2	ft-candles
Floor Fraction (GLFF)	0.18			
Connected Load	10.3	W/m²	1.0	W/ft²
Occ. Period(Hrs./yr.)	3500			
Unocc. Period(Hrs./yr.)	5260			
Usage During Occupied Period	100%			
Usage During Unoccupied Period	25%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	300	500	700	1000	Total
% Distribution	50%	50%	0%	0%	100%
Weighted Average					**400**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			0.0%	0%	100.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI		
	kWh/ft².yr	0.8
	MJ/m².yr	32

ARCHITECTURAL LIGHTING

Light Level	300	Lux	27.9	ft-candles
Floor Fraction (ALFF)	0.01			
Connected Load	23.3	W/m²	2.2	W/ft²
Occ. Period(Hrs./yr.)	2500			
Unocc. Period(Hrs./yr.)	6260			
Usage During Occupied Period	100%			
Usage During Unoccupied Period	50%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	300	500	700	1000	Total
% Distribution	100%	0%	0%	0%	100%
Weighted Average					**300**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	33%	67%					0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI		
	kWh/ft².yr	0.1
	MJ/m².yr	5

SPECIAL PURPOSE LIGHTING

Light Level	400.00	Lux	37.2	ft-candles
Floor Fraction (HBLFF)	0.81			
Connected Load	15.6	W/m²	1.5	W/ft²
Occ. Period(Hrs./yr.)	3500			
Unocc. Period(Hrs./yr.)	5260			
Usage During Occupied Period	100%			
Usage During Unoccupied Period	25%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 | 1.00

Light Level (Lux)	300	500	700	1000	Total
% Distribution	50%	50%	0%	0%	100%
Weighted Average					**400**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)						85%	15%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.7	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI		
	kWh/ft².yr	5.7
	MJ/m².yr	219

TOTAL LIGHTING

Overall LPD	14.73 W/m²	EUI TOTAL	kWh/ft².yr	6.6
	1.37 W/ft²		MJ/m².yr	256

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Servers		Plug Loads	
Measured Power (W/device)	55		51		100		200		217			
Density (device/occupant)	0.5918		0.5918		0.03		0.03		0.06			
Connected Load	0.3	W/m²	0.3	W/m²	0.0	W/m²	0.1	W/m²	0.5	W/m²	2.5	W/m²
	0.0	W/ft²	0.0	W/ft²	0.00	W/ft²	0.01	W/ft²	0.05	W/ft²	0.23	W/ft²
Diversity Occupied Period	90%		90%		90%		90%		100%		90%	
Diversity Unoccupied Period	50%		50%		50%		50%		100%		25%	
Operation Occ. Period (hrs./year)	2000		2000		2600		2600		2600		4100	
Operation Unocc. Period (hrs./year)	6760		6760		6160		6160		6160		4660	

Total end-use load (occupied period)	3.4	W/m²	0.3	W/ft²
Total end-use load (unocc. period)	1.5	W/m²	0.1	W/ft²
Usage during occupied period	100%			
Usage during unoccupied period	44%			

	EUI		
Computer Equipment	EUI	kWh/ft².yr	0.76
		MJ/m².yr	29.58
Plug Loads	EUI	kWh/ft².yr	1.13
		MJ/m².yr	43.70

FOOD SERVICE EQUIPMENT

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	0.1	EUI	kWh/ft².yr	0.1
	MJ/m².yr	5.0		MJ/m².yr	5.0

REFRIGERATION

Provide description below:

Large refrigeration storage

EUI		
	kWh/ft².yr	1.3
	MJ/m².yr	50.0

MISCELLANEOUS

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	0.3	EUI	kWh/ft².yr	0.5
	MJ/m².yr	10.0		MJ/m².yr	20.0

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Warehouse/Whsale	0		Vancouver Island
Baseline			

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						Gas	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Radiant	
System Present (%)	2%	5%	1%	35%	7%	30%		2%	3%	15%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	75%	1.70	3.00	100%	75%	
Performance (1 / Eff. (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.33	0.59	0.33	1.00	1.33	

Peak Heating Load	20.9 W/m²	6.6 Btu/hr.ft²	
Seasonal Heating Load (Tertiary Load)	167 MJ/m².yr	4.3 kWh/ft².yr	
Sizing Factor	1.00		
Electric Fuel Share	5.0%	Fossil Fuel Share	95.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	kWh/ft².yr	3.2
	MJ/m².yr	122
Gas EUI	kWh/ft².yr	5.7
	MJ/m².yr	220
Market Composite EUI	kWh/ft².yr	5.6
	MJ/m².yr	215

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	0.0%	0.0%	0.0%	10.0%	90.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7 °C	44.6 °F
Condenser Water	30 °C	86 °F
Supply Air	13.0 °C	55.4 °F

Peak Cooling Load	34 W/m²	11 Btu/hr.ft²	1110 ft²/Ton
Seasonal Cooling Load (Tertiary Load)	59.5 MJ/m².yr	1.5 kWh/ft².yr	

Sizing Factor 1.00 Operation (occ. period) 3000 hrs/year Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C) 30.0%

Electric Fuel Share 100.0% Gas Fuel Share 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenan

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	kWh/ft².yr	0.4
	MJ/m².yr	15
Natural Gas EUI	kWh/ft².yr	0.0
	MJ/m².yr	0
Market Composite EUI	kWh/ft².yr	0.4
	MJ/m².yr	15

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	65%				5%
Eff./COP	0.65				0.75

	Fossil		Elec. Res.
Fuel Share	70%		30%
Blended Efficiency	0.66		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 22.5

Wetting Use Percentage 90%

All Electric EUI	kWh/ft².yr	0.6
	MJ/m².yr	25
Fossil Fuel EUI	kWh/ft².yr	0.9
	MJ/m².yr	34
Market Composite EUI	kWh/ft².yr	0.8
	MJ/m².yr	31.4

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EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Warehouse/Whsale	0		Vancouver Island
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	1.2	L/s.m²	0.24	CFM/ft²
System Static Pressure CAV	425	Pa	1.7	wg
System Static Pressure VAV	425	Pa	1.7	wg
Fan Efficiency	60%			
Fan Motor Efficiency	80%			
Sizing Factor	1.00			
Fan Design Load CAV	1.1	W/m²	0.10	W/ft²
Fan Design Load VAV	1.1	W/m²	0.10	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	100%	0%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	0%	100%	100%	0%
Comments:				

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m²	0.01	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.2	L/s.m²	0.03	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.2	W/m²	0.02	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.020	kW/kW	0.07	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	0.68	W/m²	0.06	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.002	L/s.m²	0.003	U.S. gpm/ft²
Pump Head Pressure	0	kPa	0	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.00	W/m²	0.00	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.001	L/s.m²	0.0022	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	50	kPa	17	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.1	W/m²	0.01	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	3.8	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	1.9	kWh/m².yr
Condenser Pump Energy Consumption	0.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.2	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	0.6	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI		
	kWh/ft².yr	0.6
	MJ/m².yr	23.3

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Warehouse/Whsale	0		Vancouver Island
Baseline			

EUI SUMMARY

TOTAL ALL END-USES: **Electricity:** 12.2 kWh/ft².yr 474.2 MJ/m².yr **Fossil Fue** 6.4 kWh/ft².yr 247.7 MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	0.8	32.2
ARCHITECTURAL LIGHTING	0.1	4.7
SPECIAL PURPOSE LIGHTING	5.7	219.1
OTHER PLUG LOADS	1.1	43.7
HVAC FANS & PUMPS	0.6	23.3
REFRIGERATION	1.3	50.0
COMPUTER EQUIPMENT	0.8	29.6
ELEVATORS	0.3	11.6
OUTDOOR LIGHTING	0.4	17.0

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.2	6.1	5.4	208.7
SPACE COOLING	0.1	4.5	0.0	0.0
DOMESTIC HOT WATER	0.2	7.4	0.6	24.0
FOOD SERVICE EQUIPMENT	0.1	5.0	0.1	5.0
MISCELLANEOUS	0.5	20.0	0.3	10.0

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Large High Rise	**> 9,300 m² (100,000 ft²)**		**Vancouver Island**
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.81	W/m².°C	0.14	Btu/hr.ft² . °F	Typical Building Size	21,365 m²	229,887	ft²
Roof U value (W/m².°C)	0.34	W/m².°C	0.06	Btu/hr.ft² . °F	Typical Footprint (m²)	1,125 m²	12,100	ft²
Glazing U value (W/m².°C)	3.50	W/m².°C	0.62	Btu/hr.ft² . °F	Footprint Aspect Ratio (L:W)	1		
					Percent Conditioned Space	100%		
					Percent Conditioned Space Defined as Exterior Zone	45%		
Window/Wall Ratio (WIWAR) (%)	0.25							
Shading Coefficient (SC)	0.65				Typical # Stories	19		
					Floor to Floor Height (m)	3.7 m	12.0	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	100%		0%		0%		0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	40	m²/person	430	ft²/person	%OA 100.00%
Occupancy Schedule Occ. Period	25%				
Occupancy Schedule Unocc. Period	80%				
Fresh Air Requirements or Outside Air	10	L/s.person	21	CFM/person	

Fresh Air Control Type *(enter a 1, 2 or 3) | 3 | If Fresh Air Control Type = "2" enter % FA. to the right: | 0%

(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air) | If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation | 0.25 L/s.m² | 0.05 CFM/ft² | 75% operation (%)

Sizing Factor	1			
Total Air Circulation or Design Air Flow	0.25	L/s.m²	0.05	CFM/ft²
Infiltration Rate	0.05	L/s.m²	0.01	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)		L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	2,642,779	
Peak Zone Sensible Load	1,561,102	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	72,622	
Total air circulation or Design air	1.60	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	20	°C	68	°F	13	°C	55.4	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	20.4	°C	68.72	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning — Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large High Rise	> 9,300 m² (100,000 ft²)		Vancouver Island
Baseline			

LIGHTING

GENERAL (Linear Fluorescent) LIGHTING

Light Level	160	Lux	14.9	ft-candles
Floor Fraction (GLFF)	0.10			
Connected Load	4.1	W/m²	0.4	W/ft²

Occ. Period(Hrs./yr.)	3400
Unocc. Period(Hrs./yr.)	5360
Usage During Occupied Period	90%
Usage During Unoccupied Period	90%
Fixture Cleaning:	
Incidence of Practice	
Interval	years
Relamping Strategy & Incidence of Practice	Group / Spot

Light Level (Lux)	50	100	200	300				Total
% Distribution	0%	60%	20%	20%				100%
Weighted Average								**160**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			0.0%	0%	100.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	0.3
	MJ/m².yr	12

ARCHITECTURAL (Incandescent & replacements) LIGHTING

Light Level	130	Lux	12.1	ft-candles
Floor Fraction (ALFF)	0.90			
Connected Load	9.7	W/m²	0.9	W/ft²

Occ. Period(Hrs./yr.)	2900
Unocc. Period(Hrs./yr.)	5860
Usage During Occupied Period	25%
Usage During Unoccupied Period	20%
Fixture Cleaning:	
Incidence of Practice	
Interval	years
Relamping Strategy & Incidence of Practice	Group / Spot

Light Level (Lux)	50	200	300	500				Total
% Distribution	60%	20%	20%	0%				100%
Weighted Average								**130**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	30%	70%					0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	1.5
	MJ/m².yr	60

SPECIAL PURPOSE LIGHTING

Light Level	0.00	Lux	0.0	ft-candles
Floor Fraction (HBLFF)	0.00			
Connected Load	0.0	W/m²	0.0	W/ft²

Floor fraction check: should = 1.00 — 1.00

Occ. Period(Hrs./yr.)	4000
Unocc. Period(Hrs./yr.)	4760
Usage During Occupied Period	0%
Usage During Unoccupied Period	100%
Fixture Cleaning:	
Incidence of Practice	
Interval	years
Relamping Strategy & Incidence of Practice	Group / Spot

Light Level (Lux)	300	500	700	1000				Total
% Distribution		0%	0%	0%				0%
Weighted Average								**0**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)								0.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	0.0
	MJ/m².yr	0

TOTAL LIGHTING

Overall LPD	9.16 W/m²	EUI TOTAL	kWh/ft².yr	1.8
	0.85 W/ft²		MJ/m².yr	71

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Servers	Plug Loads
Measured Power (W/device)	45	57	100	200	50	
Density (device/occupant)	0.8	0.8	0	0	0.00	
Connected Load	0.9 W/m²	1.1 W/m²	0.0 W/m²	0.0 W/m²	0.5 W/m²	1.8 W/m²
	0.1 W/ft²	0.1 W/ft²	0.00 W/ft²	0.00 W/ft²	0.05 W/ft²	0.17 W/ft²
Diversity Occupied Period	0%	0%	90%	90%	100%	40%
Diversity Unoccupied Period	50%	50%	50%	10%	100%	85%
Operation Occ. Period (hrs./year)	2900	2900	2600	2600	2600	3000
Operation Unocc. Period (hrs./year)	5860	5860	6160	6160	6160	5760

Total end-use load (occupied period)	1.2 W/m²	0.1 W/ft²
Total end-use load (unocc. period)	3.1 W/m²	0.3 W/ft²
Usage during occupied period	100%	
Usage during unoccupied period	249%	

Computer Equipment	EUI	kWh/ft².yr	0.98
		MJ/m².yr	37.77
Plug Loads	EUI	kWh/ft².yr	1.02
		MJ/m².yr	39.50

FOOD SERVICE EQUIPMENT

Provide description below:

Electric stoves (at 417 kWh/yr), etc.

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	0.3	EUI	kWh/ft².yr	0.7
	MJ/m².yr	10.0		MJ/m².yr	27.0

REFRIGERATION

Provide description below:

Residential refrigerators (560 kWh/yr) and freezers (370 kWh/yr)

EUI	kWh/ft².yr	0.7
	MJ/m².yr	26.0

MISCELLANEOUS

Provide description below:

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	1.0	EUI	kWh/ft².yr	0.4
	MJ/m².yr	40.0		MJ/m².yr	15.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large High Rise	> 9,300 m² (100,000 ft²)		Vancouver Island
Baseline			

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	5%	30%	10%	25%	15%	0%	3%	3%	9%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff. (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	15.9	W/m²	5.0	Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	223	MJ/m².yr	5.8	kWh/ft².yr
Sizing Factor	1.00			
Electric Fuel Share	15.0%	Fossil Fuel Share	85.0%	

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	4.5
MJ/m².yr	175

Gas EUI	
kWh/ft².yr	7.3
MJ/m².yr	281

Market Composite EUI	
kWh/ft².yr	6.9
MJ/m².yr	265

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	1.0%	0.0%		5.0%	94.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7	°C	44.6	°F
Condenser Water	30	°C	86	°F
Supply Air	13.0	°C	55.4	°F

Peak Cooling Load	5	W/m²	2	Btu/hr.ft²	6959	ft²/Ton
Seasonal Cooling Load (Tertiary Load)	58.8	MJ/m².yr	1.5	kWh/ft².yr		

Sizing Factor 0.15 — Operation (occ. period) 3000 hrs/year — Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C) 15.0%

Electric Fuel Share 100.0% — Gas Fuel Share 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenan

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	0.4
MJ/m².yr	16

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	0.4
MJ/m².yr	16

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	25%				50%
Eff./COP	0.65				0.75

	Fossil	Elec. Res.
Fuel Share	75%	25%
Blended Efficiency	0.72	1.00

Service Hot Water load (MJ/m².yr) (Tertiary Load) 200.0

Wetting Use Percentage 80%

All Electric EUI	
kWh/ft².yr	5.2
MJ/m².yr	200

Fossil Fuel EUI	
kWh/ft².yr	7.2
MJ/m².yr	279

Market Composite EUI	
kWh/ft².yr	6.7
MJ/m².yr	259.3

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large High Rise	> 9,300 m² (100,000 ft²)		Vancouver Island
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	0.3	L/s.m²	0.05	CFM/ft²
System Static Pressure CAV	625	Pa	2.5	wg
System Static Pressure VAV	0	Pa	0.0	wg
Fan Efficiency	52%			
Fan Motor Efficiency	90%			
Sizing Factor	1.00			
Fan Design Load CAV	0.3	W/m²	0.03	W/ft²
Fan Design Load VAV	0.0	W/m²	0.00	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	100%	0%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	75%	25%	75%	25%

Comments:

EXHAUST FANS

Washroom Exhaust	50	L/s.washroom	106	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m²	0.02	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.2	L/s.m²	0.04	CFM/ft²
Exhaust System Static Pressure	125	Pa	0.5	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.1	W/m²	0.01	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.000	kW/kW	0.00	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	0.00	W/m²	0.00	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.000	L/s.m²	0.000	U.S. gpm/ft²
Pump Head Pressure	0	kPa	0	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.00	W/m²	0.00	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.000	L/s.m²	0.0003	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.0	W/m²	0.00	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	2.5	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	0.9	kWh/m².yr
Condenser Pump Energy Consumption	0.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.0	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	0.2	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI	kWh/ft².yr	0.3
	MJ/m².yr	13.2

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Large High Rise	**> 9,300 m² (100,000 ft²)**		**Vancouver Island**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**8.7**	kWh/ft².yr	**337.1**	MJ/m².yr	**Fossil Fue**	**12.9**	kWh/ft².yr	**498.6**	MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL (Linear Fluorescent) LIGHT	0.3	11.7
ARCHITECTURAL (Incandescent & re	1.5	59.7
SPECIAL PURPOSE LIGHTING	0.0	0.0
OTHER PLUG LOADS	1.0	39.5
HVAC FANS & PUMPS	0.3	13.2
REFRIGERATION	0.7	26.0
COMPUTER EQUIPMENT	1.0	37.8
ELEVATORS	0.3	11.6
OUTDOOR LIGHTING	0.4	17.0

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.7	26.2	6.2	239.3
SPACE COOLING	0.1	2.4	0.0	0.0
DOMESTIC HOT WATER	1.3	50.0	5.4	209.3
FOOD SERVICE EQUIPMENT	0.7	27.0	0.3	10.0
MISCELLANEOUS	0.4	15.0	1.0	40.0

COMMERCIAL SECTOR BUILDING PROFILE

New BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Apartment			Vancouver Island
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.81	W/m².°C	0.14	Btu/hr.ft² . °F
Roof U value (W/m².°C)	0.34	W/m².°C	0.06	Btu/hr.ft² . °F
Glazing U value (W/m².°C)	3.50	W/m².°C	0.62	Btu/hr.ft² . °F
Window/Wall Ratio (WIWAR) (%)	0.25			
Shading Coefficient (SC)	0.65			

Typical Building Size	8,000	m²	86,080	ft²
Typical Footprint (m²)	1,600	m²	17,216	ft²
Footprint Aspect Ratio (L:W)	3			
Percent Conditioned Space	100%			
Percent Conditioned Space Defined as Exterior Zone	45%			
Typical # Stories	5			
Floor to Floor Height (m)	3.7	m	12.0	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	100%		0%		0%		0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	40	m²/person	430	ft²/person
Occupancy Schedule Occ. Period	25%			
Occupancy Schedule Unocc. Period	80%			
Fresh Air Requirements or Outside Air	10	L/s.person	21	CFM/person

%OA 100.00%

Fresh Air Control Type *(enter a 1, 2 or 3) 3
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right:	0%			
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation	0.25	L/s.m²	0.05	CFM/ft²
	75%	operation (%)		

Sizing Factor	1			
Total Air Circulation or Design Air Flow	0.25	L/s.m²	0.05	CFM/ft²
Infiltration Rate	0.05	L/s.m²	0.01	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)		L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	914,326	
Peak Zone Sensible Load	509,308	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	23,693	
Total air circulation or Design air	1.40	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	23	°C	73.4	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	20.4	°C	68.72	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning — Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

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COMMERCIAL SECTOR BUILDING PROFILE

New BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Medium Apartment			**Vancouver Island**
Baseline			

LIGHTING

GENERAL (Linear Fluorescent) LIGHTING

Light Level	160	Lux	14.9	ft-candles
Floor Fraction (GLFF)	0.10			
Connected Load	4.1	W/m²	0.4	W/ft²

Occ. Period(Hrs./yr.)	3400	
Unocc. Period(Hrs./yr.)	5360	
Usage During Occupied Period	90%	
Usage During Unoccupied Period	90%	
Fixture Cleaning:		
Incidence of Practice		
Interval		years
Relamping Strategy & Incidence of Practice	Group	Spot

Light Level (Lux)	50	100	200	300	Total
% Distribution	0%	60%	20%	20%	100%
Weighted Average					**160**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			0.0%	0%	100.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	0.3
	MJ/m².yr	12

ARCHITECTURAL (Incandescent & replacements) LIGHTING

Light Level	130	Lux	12.1	ft-candles
Floor Fraction (ALFF)	0.90			
Connected Load	9.7	W/m²	0.9	W/ft²

Occ. Period(Hrs./yr.)	2900	
Unocc. Period(Hrs./yr.)	5860	
Usage During Occupied Period	25%	
Usage During Unoccupied Period	20%	
Fixture Cleaning:		
Incidence of Practice		
Interval		years
Relamping Strategy & Incidence of Practice	Group	Spot

Light Level (Lux)	50	200	300	500	Total
% Distribution	60%	20%	20%	0%	100%
Weighted Average					**130**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	30%	70%					0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI	kWh/ft².yr	1.5
	MJ/m².yr	60

EUI = Load X Hrs. X SF X GLFF

SPECIAL PURPOSE LIGHTING

Light Level	0.00	Lux	0.0	ft-candles
Floor Fraction (HBLFF)	0.00			
Connected Load	0.0	W/m²	0.0	W/ft²

Floor fraction check: should = 1.00 — 1.00

Occ. Period(Hrs./yr.)	4000	
Unocc. Period(Hrs./yr.)	4760	
Usage During Occupied Period	0%	
Usage During Unoccupied Period	100%	
Fixture Cleaning:		
Incidence of Practice		
Interval		years
Relamping Strategy & Incidence of Practice	Group	Spot

Light Level (Lux)	300	500	700	1000	Total
% Distribution		0%	0%	0%	0%
Weighted Average					**0**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)								0.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	0.0
	MJ/m².yr	0

TOTAL LIGHTING

Overall LPD	9.16 W/m²	EUI TOTAL	kWh/ft².yr	1.8
	0.85 W/ft²		MJ/m².yr	71

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Servers		Plug Loads	
Measured Power (W/device)	45		57		100		200		50			
Density (device/occupant)	0.8		0.8		0		0		0.00			
Connected Load	0.9	W/m²	1.1	W/m²	0.0	W/m²	0.0	W/m²	0.5	W/m²	1.8	W/m²
	0.1	W/ft²	0.1	W/ft²	0.00	W/ft²	0.00	W/ft²	0.05	W/ft²	0.17	W/ft²
Diversity Occupied Period	0%		0%		90%		90%		100%		40%	
Diversity Unoccupied Period	50%		50%		50%		10%		100%		85%	
Operation Occ. Period (hrs./year)	2900		2900		2600		2600		2600		3000	
Operation Unocc. Period (hrs./year)	5860		5860		6160		6160		6160		5760	

Total end-use load (occupied period)	1.2	W/m²	0.1	W/ft²
Total end-use load (unocc. period)	3.1	W/m²	0.3	W/ft²
Usage during occupied period	100%			
Usage during unoccupied period	249%			

Computer Equipment	EUI	kWh/ft².yr	0.98
		MJ/m².yr	37.77
Plug Loads	EUI	kWh/ft².yr	1.02
		MJ/m².yr	39.50

FOOD SERVICE EQUIPMENT

Provide description below:

Electric stoves (at 417 kWh/yr), etc.

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	0.1	EUI	kWh/ft².yr	0.7
	MJ/m².yr	5.0		MJ/m².yr	27.0

REFRIGERATION

Provide description below:

Residential refrigerators (560 kWh/yr) and freezers (370 kWh/yr)

EUI	kWh/ft².yr	0.7
	MJ/m².yr	26.0

MISCELLANEOUS

Provide description below:

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	0.8	EUI	kWh/ft².yr	0.0
	MJ/m².yr	30.0		MJ/m².yr	

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COMMERCIAL SECTOR BUILDING PROFILE

New BUILDINGS: Medium Apartment Baseline | **SIZE:** | **VINTAGE:** | **REGION:** Vancouver Island

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	5%	30%	10%	20%	15%	0%	3%	3%	14%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff. (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	16.6	W/m²	5.3	Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	243	MJ/m².yr	6.3	kWh/ft².yr
Sizing Factor	1.00			

Electric Fuel Share 20.0% Fossil Fuel Share 80.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	kWh/ft².yr	5.3
	MJ/m².yr	204
Gas EUI	kWh/ft².yr	7.9
	MJ/m².yr	306
Market Composite EUI	kWh/ft².yr	7.4
	MJ/m².yr	286

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	1.0%	0.0%		5.0%	94.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7	°C	44.6	°F
Condenser Water	30	°C	86	°F
Supply Air	14.0	°C	57.2	°F

Peak Cooling Load	5	W/m²	2	Btu/hr.ft²	7532	ft²/Ton
Seasonal Cooling Load (Tertiary Load)	51.9	MJ/m².yr	1.3	kWh/ft².yr		

Sizing Factor 0.15 Operation (occ. period) 3000 hrs/year Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C) 15.0%

Electric Fuel Share 100.0% Gas Fuel Share 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	kWh/ft².yr	0.4
	MJ/m².yr	14
Natural Gas EUI	kWh/ft².yr	0.0
	MJ/m².yr	0
Market Composite EUI	kWh/ft².yr	0.4
	MJ/m².yr	14

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	60%				20%
Eff./COP	0.65				0.75

	Fossil	Elec. Res.
Fuel Share	80%	20%
Blended Efficiency	0.68	1.00

Service Hot Water load (MJ/m².yr) (Tertiary Load) 200.0

Wetting Use Percentage 80%

	All Electric EUI	Fossil Fuel EUI	Market Composite EUI
kWh/ft².yr	5.2	7.6	7.2
MJ/m².yr	200	296	277.0

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COMMERCIAL SECTOR BUILDING PROFILE

New BUILDINGS: **SIZE:** **VINTAGE:** **REGION:**
Medium Apartment **Vancouver Island**
Baseline

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	0.3	L/s.m²	0.05	CFM/ft²
System Static Pressure CAV	625	Pa	2.5	wg
System Static Pressure VAV	0	Pa	0.0	wg
Fan Efficiency	52%			
Fan Motor Efficiency	90%			
Sizing Factor	1.00			
Fan Design Load CAV	0.3	W/m²	0.03	W/ft²
Fan Design Load VAV	0.0	W/m²	0.00	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	100%	0%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	75%	25%	75%	25%

Comments:

EXHAUST FANS

Washroom Exhaust	50	L/s.washroom	106	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m²	0.01	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.2	L/s.m²	0.03	CFM/ft²
Exhaust System Static Pressure	125	Pa	0.5	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.1	W/m²	0.01	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.000	kW/kW	0.00	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	0.00	W/m²	0.00	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.000	L/s.m²	0.000	U.S. gpm/ft²
Pump Head Pressure	0	kPa	0	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.00	W/m²	0.00	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.000	L/s.m²	0.0003	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.0	W/m²	0.00	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	2.5	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	0.8	kWh/m².yr
Condenser Pump Energy Consumption	0.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.0	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	0.2	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI	kWh/ft².yr	0.3
	MJ/m².yr	12.6

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COMMERCIAL SECTOR BUILDING PROFILE

New BUILDINGS: **SIZE:** **VINTAGE:** **REGION:**
Medium Apartment **Vancouver Island**
Baseline

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**8.4**	kWh/ft².yr	**325.8**	MJ/m².yr	**Fossil Fue**	**13.4** kWh/ft².yr	**517.2** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL (Linear Fluorescent) LIGHT	0.3	11.7
ARCHITECTURAL (Incandescent & re	1.5	59.7
SPECIAL PURPOSE LIGHTING	0.0	0.0
OTHER PLUG LOADS	1.0	39.5
HVAC FANS & PUMPS	0.3	12.6
REFRIGERATION	0.7	26.0
COMPUTER EQUIPMENT	1.0	37.8
ELEVATORS	0.3	11.6
OUTDOOR LIGHTING	0.4	17.0

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	1.1	40.8	6.3	245.2
SPACE COOLING	0.1	2.1	0.0	0.0
DOMESTIC HOT WATER	1.0	40.0	6.1	237.0
FOOD SERVICE EQUIPMENT	0.7	27.0	0.1	5.0
MISCELLANEOUS	0.0	0.0	0.8	30.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: Large Office Baseline
SIZE: > 9,300 m² (100,000 ft²)
VINTAGE:
REGION: Inland North

CONSTRUCTION

Wall U value (W/m².°C)	0.78	W/m².°C	0.14	Btu/hr.ft² . °F
Roof U value (W/m².°C)	0.34	W/m².°C	0.06	Btu/hr.ft² . °F
Glazing U value (W/m².°C)	3.50	W/m².°C	0.62	Btu/hr.ft² . °F
Window/Wall Ratio (WIWAR) (%)	0.60			
Shading Coefficient (SC)	0.40			

Typical Building Size	21,365	m²	229,887	ft²
Typical Footprint (m²)	1,526	m²	16,421	ft²
Footprint Aspect Ratio (L:W)	1			
Percent Conditioned Space	100%			
Percent Conditioned Space Defined as Exterior Zone	45%			
Typical # Stories	14			
Floor to Floor Height (m)	3.7	m	12.0	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	50%		0%		50%		0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	26	m²/person	274	ft²/person
Occupancy Schedule Occ. Period	90%			
Occupancy Schedule Unocc. Period	0%			
Fresh Air Requirements or Outside Air	15	L/s.person	32	CFM/person

%OA 11.64%

Fresh Air Control Type *(enter a 1, 2 or 3) 1
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right: 34%
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation 0.5 L/s.m² 0.10 CFM/ft²; 50% operation (%)

Sizing Factor	1.7			
Total Air Circulation or Design Air Flow	5.06	L/s.m²	1.00	CFM/ft²
Infiltration Rate	0.19	L/s.m²	0.04	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	5,550,805	
Peak Zone Sensible Load	2,893,664	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	134,613	
Total air circulation or Design air	5.06	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	24	°C	75.2	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	20.4	°C	68.72	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Office	> 9,300 m² (100,000 ft²)		Inland North
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	440	Lux	40.9	ft-candles
Floor Fraction (GLFF)	0.95			
Connected Load	11.4	W/m²	1.1	W/ft²
Occ. Period(Hrs./yr.)	2900			
Unocc. Period(Hrs./yr.)	5860			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	25%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	300	500	700	1000				Total
% Distribution	30%	70%	0%	0%				100%
Weighted Average								**440**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)					100.0%			100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	4.2
	MJ/m².yr	164

ARCHITECTURAL LIGHTING

Light Level	300	Lux	27.9	ft-candles
Floor Fraction (ALFF)	0.05			
Connected Load	20.9	W/m²	1.9	W/ft²
Occ. Period(Hrs./yr.)	3400			
Unocc. Period(Hrs./yr.)	5360			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	50%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	300	500	700	1000				Total
% Distribution	100%	0%	0%	0%				100%
Weighted Average								**300**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	25%	75%					0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	0.6
	MJ/m².yr	22

SPECIAL PURPOSE LIGHTING

Light Level	0.00	Lux	0.0	ft-candles
Floor Fraction (HBLFF)	0.00			
Connected Load	0.0	W/m²	0.0	W/ft²
Occ. Period(Hrs./yr.)	4000			
Unocc. Period(Hrs./yr.)	4760			
Usage During Occupied Period	0%			
Usage During Unoccupied Period	100%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 | 1.00

Light Level (Lux)	300	500	700	1000				Total
% Distribution		0%	0%	0%				0%
Weighted Average								**0**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)								0.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	0.0
	MJ/m².yr	0

TOTAL LIGHTING

Overall LPD	11.84 W/m²	EUI TOTAL	kWh/ft².yr	4.8
	1.10 W/ft²		MJ/m².yr	186

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Servers		Plug Loads	
Measured Power (W/device)	55		51		100		200		217			
Density (device/occupant)	0.9		0.9		0.15		0.1		0.06			
Connected Load	1.9	W/m²	1.8	W/m²	0.6	W/m²	0.8	W/m²	0.5	W/m²	2.5	W/m²
	0.2	W/ft²	0.2	W/ft²	0.05	W/ft²	0.07	W/ft²	0.05	W/ft²	0.23	W/ft²
Diversity Occupied Period	90%		90%		90%		90%		100%		90%	
Diversity Unoccupied Period	50%		50%		50%		50%		100%		25%	
Operation Occ. Period (hrs./year)	2500		2500		2500		2500		2500		3000	
Operation Unocc. Period (hrs./year)	6260		6260		6260		6260		6260		5760	

Total end-use load (occupied period)	7.3	W/m²	0.7	W/ft²
Total end-use load (unocc. period)	3.7	W/m²	0.3	W/ft²
Usage during occupied period	100%			
Usage during unoccupied period	50%			

Computer Equipment	EUI	kWh/ft².yr	2.96
		MJ/m².yr	114.76
Plug Loads	EUI	kWh/ft².yr	0.96
		MJ/m².yr	37.26

FOOD SERVICE EQUIPMENT

Provide description below:

Cafeteria

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	0.3	EUI	kWh/ft².yr	0.1
	MJ/m².yr	10.0		MJ/m².yr	3.0

REFRIGERATION

Provide description below:

Unknown

EUI	kWh/ft².yr	0.1
	MJ/m².yr	4.0

MISCELLANEOUS

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	0.3	EUI	kWh/ft².yr	0.0
	MJ/m².yr	10.0		MJ/m².yr	0.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: Large Office Baseline
SIZE: > 9,300 m² (100,000 ft²)
VINTAGE:
REGION: Inland North

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	35%	35%	15%	10%	0%	0%	1%	1%	3%	0%	100%
Seasonal Eff./COP	75%	80%	90%	77%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff.) (kW/kW)	1.33	1.25	1.11	1.30	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	59.8 W/m²	19.0 Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	382 MJ/m².yr	9.9 kWh/ft².yr
Sizing Factor	1.00	
Electric Fuel Share	5.0%	Fossil Fuel Share 95.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	7.7
MJ/m².yr	299

Gas EUI	
kWh/ft².yr	12.5
MJ/m².yr	483

Market Composite EUI	
kWh/ft².yr	12.2
MJ/m².yr	473

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	0.0%	70.0%	20.0%	5.0%	5.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7 °C	44.6 °F
Condenser Water	30 °C	86 °F
Supply Air	14.0 °C	57.2 °F

Peak Cooling Load	76 W/m²	24 Btu/hr.ft²	497 ft²/Ton
Seasonal Cooling Load (Tertiary Load)	104.0 MJ/m².yr	2.7 kWh/ft².yr	

Sizing Factor 1.00 — Operation (occ. period) 3000 hrs/year Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C) 90.0%

Electric Fuel Share 100.0% — Gas Fuel Share 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	1.0
MJ/m².yr	40

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	1.0
MJ/m².yr	40

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	40%				30%
Eff./COP	0.65				0.80

	Fossil		Elec. Res.
Fuel Share	70%		30%
Blended Efficiency	0.71		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 35.0

Wetting Use Percentage 90%

All Electric EUI	
kWh/ft².yr	1.0
MJ/m².yr	38

Fossil Fuel EUI	
kWh/ft².yr	1.3
MJ/m².yr	49

Market Composite EUI	
kWh/ft².yr	1.2
MJ/m².yr	45.8

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Office	> 9,300 m² (100,000 ft²)		Inland North
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	5.1	L/s.m²	1.00	CFM/ft²
System Static Pressure CAV	900	Pa	3.6	wg
System Static Pressure VAV	900	Pa	3.6	wg
Fan Efficiency	52%			
Fan Motor Efficiency	85%			
Sizing Factor	1.00			
Fan Design Load CAV	10.3	W/m²	0.96	W/ft²
Fan Design Load VAV	10.3	W/m²	0.96	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	50%	50%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	50%	50%	100%	0%
Comments:				

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m²	0.03	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.2	L/s.m²	0.05	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	80%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.3	W/m²	0.03	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.020	kW/kW	0.07	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	1.52	W/m²	0.14	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.004	L/s.m²	0.006	U.S. gpm/ft²
Pump Head Pressure	90	kPa	30	ft
Pump Efficiency	55%			
Pump Motor Efficiency	85%			
Sizing Factor	1.0			
Pump Connected Load	0.78	W/m²	0.07	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.003	L/s.m²	0.0048	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	150	kPa	50	ft		
Pump Efficiency	55%					
Pump Motor Efficiency	85%					
Sizing Factor	0.8					
Pump Connected Load	0.8	W/m²	0.08	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	50.3	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	2.5	kWh/m².yr
Condenser Pump Energy Consumption	1.2	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.6	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	4.2	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI		
	kWh/ft².yr	5.5
	MJ/m².yr	211.4

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Large Office	**> 9,300 m² (100,000 ft²)**		**Inland North**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**16.7** kWh/ft².yr	**647.5** MJ/m².yr	**Fossil Fue**	**13.2** kWh/ft².yr	**512.8** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	4.2	164.0
ARCHITECTURAL LIGHTING	0.6	22.2
SPECIAL PURPOSE LIGHTING	0.0	0.0
OTHER PLUG LOADS	1.0	37.3
HVAC FANS & PUMPS	5.5	211.4
REFRIGERATION	0.1	4.0
COMPUTER EQUIPMENT	3.0	114.8
ELEVATORS	0.3	11.6
OUTDOOR LIGHTING	0.4	17.0

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.4	15.0	11.8	458.5
SPACE COOLING	0.9	35.7	0.0	0.0
DOMESTIC HOT WATER	0.3	11.5	0.9	34.3
FOOD SERVICE EQUIPMENT	0.1	3.0	0.3	10.0
MISCELLANEOUS	0.0	0.0	0.3	10.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Medium Office	**50,000 to 100,000 ft²**		**Inland North**
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.66	W/m².°C	0.12	Btu/hr.ft² . °F	Typical Building Size	6,777	m²	72,921	ft²
Roof U value (W/m².°C)	0.34	W/m².°C	0.06	Btu/hr.ft² . °F	Typical Footprint (m²)	753	m²	8,102	ft²
Glazing U value (W/m².°C)	3.50	W/m².°C	0.62	Btu/hr.ft² . °F	Footprint Aspect Ratio (L:W)	1			
					Percent Conditioned Space	100%			
					Percent Conditioned Space Defined as Exterior Zone	45%			
Window/Wall Ratio (WIWAR) (%)	0.45								
Shading Coefficient (SC)	0.45				Typical # Stories	9			
					Floor to Floor Height (m)	3.7	m	12.0	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	50%		0%		50%		0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	26	m²/person	274	ft²/person	%OA	10.82%
Occupancy Schedule Occ. Period	90%					
Occupancy Schedule Unocc. Period	0%					
Fresh Air Requirements or Outside Air	15	L/s.person	32	CFM/person		

Fresh Air Control Type *(enter a 1, 2 or 3)	1	If Fresh Air Control Type = "2" enter % FA. to the right:	34%			
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)		If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation	0.5	L/s.m²	0.10	CFM/ft²
			50%	operation (%)		

Sizing Factor	1.6			
Total Air Circulation or Design Air Flow	5.43	L/s.m²	1.07	CFM/ft²
Infiltration Rate	0.19	L/s.m²	0.04	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based	Total
Incidence of Use	0%		100%	100%
Switchover Point		KJ/kg.	18	°C
		Btu/lbm	64.4	°F

Summary of Design Parameters		
Peak Design Cooling Load	1,891,294	
Peak Zone Sensible Load	1,048,446	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	48,774	
Total air circulation or Design air	5.43	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	22	°C	71.6	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	20.4	°C	68.72	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning — Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Office	50,000 to 100,000 ft^2		Inland North
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	460	Lux	42.8	ft-candles
Floor Fraction (GLFF)	0.98			
Connected Load	11.9	W/m^2	1.1	W/ft^2
Occ. Period(Hrs./yr.)	2900			
Unocc. Period(Hrs./yr.)	5860			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	25%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	300	500	700	1000				Total
% Distribution	20%	80%	0%	0%				100%
Weighted Average								**460**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			0.0%		100.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft^2.yr	4.6
	MJ/m^2.yr	177

ARCHITECTURAL LIGHTING

Light Level	300	Lux	27.9	ft-candles
Floor Fraction (ALFF)	0.02			
Connected Load	20.9	W/m^2	1.9	W/ft^2
Occ. Period(Hrs./yr.)	3400			
Unocc. Period(Hrs./yr.)	5360			
Usage During Occupied Period	100%			
Usage During Unoccupied Period	90%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	300	500	700	1000				Total
% Distribution	100%	0%	0%	0%				100%
Weighted Average								**300**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	25%	75%					0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft^2.yr	0.3
	MJ/m^2.yr	12

SPECIAL PURPOSE LIGHTING

Light Level	0.00	Lux	0.0	ft-candles
Floor Fraction (HBLFF)	0.00			
Connected Load	0.0	W/m^2	0.0	W/ft^2
Occ. Period(Hrs./yr.)	3400			
Unocc. Period(Hrs./yr.)	5360			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	40%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 | 1.00

Light Level (Lux)	300	500	700	1000				Total
% Distribution		0%	0%	0%				0%
Weighted Average								**0**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)								0.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft^2.yr	0.0
	MJ/m^2.yr	0

TOTAL LIGHTING

Overall LPD	12.06 W/m^2	EUI TOTAL	kWh/ft^2.yr	4.9
	1.12 W/ft^2		MJ/m^2.yr	189

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Servers		Plug Loads	
Measured Power (W/device)	55		51		100		200		217			
Density (device/occupant)	0.9		0.9		0.15		0.1		0.06			
Connected Load	1.9	W/m^2	1.8	W/m^2	0.6	W/m^2	0.8	W/m^2	0.5	W/m^2	1	W/m^2
	0.2	W/ft^2	0.2	W/ft^2	0.05	W/ft^2	0.07	W/ft^2	0.05	W/ft^2	0.09	W/ft^2
Diversity Occupied Period	90%		90%		90%		90%		100%		80%	
Diversity Unoccupied Period	50%		50%		50%		50%		100%		25%	
Operation Occ. Period (hrs./year)	2500		2500		2500		2500		2500		2500	
Operation Unocc. Period (hrs./year)	6260		6260		6260		6260		6260		6260	

Total end-use load (occupied period)	5.9	W/m^2	0.5	W/ft^2
Total end-use load (unocc. period)	3.3	W/m^2	0.3	W/ft^2
Usage during occupied period	100%			
Usage during unoccupied period	56%			

Computer Equipment	EUI	kWh/ft^2.yr	2.96
		MJ/m^2.yr	114.76
Plug Loads	EUI	kWh/ft^2.yr	0.33
		MJ/m^2.yr	12.83

FOOD SERVICE EQUIPMENT

Provide description below:

Lunch room/cafeteria/restaurant

Gas EUI			Electric EUI		
EUI	kWh/ft^2.yr	0.3	EUI	kWh/ft^2.yr	0.1
	MJ/m^2.yr	10.0		MJ/m^2.yr	3.0

REFRIGERATION

Provide description below:

Lunch room/cafeteria/restaurant

EUI	kWh/ft^2.yr	0.1
	MJ/m^2.yr	4.0

MISCELLANEOUS

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft^2.yr	0.5	EUI	kWh/ft^2.yr	0.0
	MJ/m^2.yr	20.0		MJ/m^2.yr	

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Office	50,000 to 100,000 ft²		Inland North
Baseline			

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	5%	35%	10%	45%	0%	0%	2%	1%	2%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff. (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load: 68.6 W/m² — 21.8 Btu/hr.ft²
Seasonal Heating Load (Tertiary Load): 443 MJ/m².yr — 11.4 kWh/ft².yr
Sizing Factor: 1.00

Electric Fuel Share: 5.0% Fossil Fuel Share: 95.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	kWh/ft².yr	8.0
	MJ/m².yr	311
Gas EUI	kWh/ft².yr	14.6
	MJ/m².yr	566
Market Composite EUI	kWh/ft².yr	14.3
	MJ/m².yr	553

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	0.0%	5.0%	20.0%	5.0%	70.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7 °C	44.6 °F
Condenser Water	30 °C	86 °F
Supply Air	14.0 °C	57.2 °F

Peak Cooling Load: 82 W/m² — 26 Btu/hr.ft² — 463 ft²/Ton
Seasonal Cooling Load (Tertiary Load): 122.9 MJ/m².yr — 3.2 kWh/ft².yr

Sizing Factor: 1.00 Operation (occ. period): 3000 hrs/year Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C): 80.0%

Electric Fuel Share: 100.0% Gas Fuel Share: 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenan

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	kWh/ft².yr	1.5
	MJ/m².yr	56
Natural Gas EUI	kWh/ft².yr	0.0
	MJ/m².yr	0
Market Composite EUI	kWh/ft².yr	1.5
	MJ/m².yr	56

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	60%				10%
Eff./COP	0.65				0.75

	Fossil	Elec. Res.
Fuel Share	70%	30%
Blended Efficiency	0.66	0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load): 30.0

Wetting Use Percentage: 90%

	All Electric EUI	Fossil Fuel EUI	Market Composite EUI
kWh/ft².yr	0.9	1.2	1.1
MJ/m².yr	33	45	41.5

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EXISTING BUILDINGS: **Medium Office** **Baseline**
SIZE: **50,000 to 100,000 ft²**
VINTAGE:
REGION: **Inland North**

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	5.4	L/s.m²	1.07	CFM/ft²
System Static Pressure CAV	850	Pa	3.4	wg
System Static Pressure VAV	850	Pa	3.4	wg
Fan Efficiency	52%			
Fan Motor Efficiency	88%			
Sizing Factor	1.00			
Fan Design Load CAV	10.1	W/m²	0.94	W/ft²
Fan Design Load VAV	10.1	W/m²	0.94	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	50%	50%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	50%	50%	50%	50%
Comments:				

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.3	L/s.m²	0.05	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.4	L/s.m²	0.07	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.5	W/m²	0.05	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.020	kW/kW	0.07	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	1.64	W/m²	0.15	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.004	L/s.m²	0.006	U.S. gpm/ft²
Pump Head Pressure	45	kPa	15	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.49	W/m²	0.05	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.004	L/s.m²	0.0052	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.7	W/m²	0.07	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	49.3	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	3.0	kWh/m².yr
Condenser Pump Energy Consumption	0.3	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.7	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	3.5	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI	kWh/ft².yr	5.3
	MJ/m².yr	204.4

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Medium Office	**50,000 to 100,000 ft²**		**Inland North**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**16.6** kWh/ft².yr	**642.6** MJ/m².yr	**Fossil Fuel**	**15.5** kWh/ft².yr	**599.5** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	4.6	176.9
ARCHITECTURAL LIGHTING	0.3	12.4
SPECIAL PURPOSE LIGHTING	0.0	0.0
OTHER PLUG LOADS	0.3	12.8
HVAC FANS & PUMPS	5.3	204.4
REFRIGERATION	0.1	4.0
COMPUTER EQUIPMENT	3.0	114.8
ELEVATORS	0.3	11.6
OUTDOOR LIGHTING	0.8	32.2

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.4	15.5	13.9	537.9
SPACE COOLING	1.2	45.1	0.0	0.0
DOMESTIC HOT WATER	0.3	9.9	0.8	31.6
FOOD SERVICE EQUIPMENT	0.1	3.0	0.3	10.0
MISCELLANEOUS	0.0	0.0	0.5	20.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Large Retail	**> 100,000 ft²**		**Inland North**
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.66	W/m².°C	0.12	Btu/hr.ft² . °F	Typical Building Size	24,000	m²	258,240	ft²
Roof U value (W/m².°C)	0.34	W/m².°C	0.06	Btu/hr.ft² . °F	Typical Footprint (m²)	24,000	m²	258,240	ft²
Glazing U value (W/m².°C)	3.50	W/m².°C	0.62	Btu/hr.ft² . °F	Footprint Aspect Ratio (L:W)	15			
					Percent Conditioned Space	100%			
					Percent Conditioned Space Defined as Exterior Zone	40%			
Window/Wall Ratio (WIWAR) (%)	0.10								
Shading Coefficient (SC)	0.78				Typical # Stories	1			
					Floor to Floor Height (m)	4.6	m	15.0	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	80%		0%		20%		0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	45	m²/person	484	ft²/person
Occupancy Schedule Occ. Period	90%			
Occupancy Schedule Unocc. Period	0%			
Fresh Air Requirements or Outside Air	50	L/s.person	106	CFM/person

%OA 20.42%

Fresh Air Control Type *(enter a 1, 2 or 3) 1
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right: 0%
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation 0.5 L/s.m² 0.10 CFM/ft²
50% operation (%)

Sizing Factor	2.3			
Total Air Circulation or Design Air Flow	5.44	L/s.m²	1.07	CFM/ft²
Infiltration Rate	0.38	L/s.m²	0.07	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	7,938,891	
Peak Zone Sensible Load	2,586,434	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	120,321	
Total air circulation or Design air	5.44	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	23	°C	73.4	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	20.4	°C	68.72	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Retail	> 100,000 ft²		Inland North
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	590	Lux	54.8	ft-candles
Floor Fraction (GLFF)	0.60			
Connected Load	15.2	W/m²	1.4	W/ft²
Occ. Period(Hrs./yr.)	4100			
Unocc. Period(Hrs./yr.)	4660			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	20%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	500	600	700	800	Total
% Distribution	10%	90%	0%	0%	100%
Weighted Average					**590**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)					100.0%			100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	4.1
	MJ/m².yr	159

ARCHITECTURAL LIGHTING

Light Level	575	Lux	53.4	ft-candles
Floor Fraction (ALFF)	0.15			
Connected Load	60.7	W/m²	5.6	W/ft²
Occ. Period(Hrs./yr.)	4100			
Unocc. Period(Hrs./yr.)	4660			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	30%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	400	500	600	700	Total
% Distribution	0%	25%	75%	0%	100%
Weighted Average					**575**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	60%	40%						100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	4.5
	MJ/m².yr	173

SPECIAL PURPOSE LIGHTING

Light Level	550.00	Lux	51.1	ft-candles
Floor Fraction (HBLFF)	0.25			
Connected Load	23.0	W/m²	2.1	W/ft²
Occ. Period(Hrs./yr.)	4100			
Unocc. Period(Hrs./yr.)	4660			
Usage During Occupied Period	100%			
Usage During Unoccupied Period	20%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 | 1.00

Light Level (Lux)	400	500	600	700	Total
% Distribution	0%	50%	50%	0%	100%
Weighted Average					**550**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)						100%		100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.7	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	2.7
	MJ/m².yr	104

TOTAL LIGHTING

Overall LPD	18.24 W/m²	EUI TOTAL	kWh/ft².yr	11.3
	1.70 W/ft²		MJ/m².yr	436

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Servers		Plug Loads	
Measured Power (W/device)	55		51		100		200		217			
Density (device/occupant)	0.648828		0.648828		0.01		0.01		0.03			
Connected Load	0.8	W/m²	0.7	W/m²	0.0	W/m²	0.0	W/m²	0.5	W/m²	1.75	W/m²
	0.1	W/ft²	0.1	W/ft²	0.00	W/ft²	0.00	W/ft²	0.05	W/ft²	0.16	W/ft²
Diversity Occupied Period	90%		90%		90%		90%		100%		90%	
Diversity Unoccupied Period	50%		50%		50%		50%		100%		25%	
Operation Occ. Period (hrs./year)	2000		2000		2600		2600		2600		4100	
Operation Unocc. Period (hrs./year)	6760		6760		6160		6160		6160		4660	

Total end-use load (occupied period)	3.5	W/m²	0.3	W/ft²
Total end-use load (unocc. period)	1.7	W/m²	0.2	W/ft²
Usage during occupied period	100%			
Usage during unoccupied period	50%			

	EUI		
Computer Equipment	EUI	kWh/ft².yr	1.18
		MJ/m².yr	45.81
Plug Loads	EUI	kWh/ft².yr	0.79
		MJ/m².yr	30.59

FOOD SERVICE EQUIPMENT

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	0.3	EUI	kWh/ft².yr	0.3
	MJ/m².yr	10.0		MJ/m².yr	10.0

REFRIGERATION

Provide description below:

EUI	kWh/ft².yr	0.3
	MJ/m².yr	10.0

MISCELLANEOUS

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	0.1	EUI	kWh/ft².yr	0.0
	MJ/m².yr	5.0		MJ/m².yr	0.0

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Retail	> 100,000 ft²		Inland North
Baseline			

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)		5%		87%	0%	0%	2%	1%	5%	0%	100%
Seasonal Eff./COP	75%	80%	85%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff.) (kW/kW)	1.33	1.25	1.18	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	40.9	W/m²	13.0	Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	380	MJ/m².yr	9.8	kWh/ft².yr
Sizing Factor	1.00			

Electric Fuel Share 8.0% Fossil Fuel Share 92.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	8.0
MJ/m².yr	309

Gas EUI	
kWh/ft².yr	13.0
MJ/m².yr	505

Market Composite EUI	
kWh/ft².yr	12.6
MJ/m².yr	489

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	0.0%	3.0%	0.0%	3.0%	94.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7	°C	44.6	°F
Condenser Water	30	°C	86	°F
Supply Air	14.0	°C	57.2	°F

Peak Cooling Load	97	W/m²	31	Btu/hr.ft²	390	ft²/Ton
Seasonal Cooling Load (Tertiary Load)	76.7	MJ/m².yr	2.0	kWh/ft².yr		

Sizing Factor 1.00 Operation (occ. period) 3000 hrs/year Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C) 90.0%

Electric Fuel Share 100.0% Gas Fuel Share 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

All Electric EUI	
kWh/ft².yr	0.8
MJ/m².yr	32

Cooling Tower/Air Cooled Condenser Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	0.8
MJ/m².yr	32

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	40%				10%
Eff./COP	0.65				0.75

	Fossil		Elec. Res.
Fuel Share	50%		50%
Blended Efficiency	0.67		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 30.0

Wetting Use Percentage 90%

All Electric EUI	
kWh/ft².yr	0.9
MJ/m².yr	33

Fossil Fuel EUI	
kWh/ft².yr	1.2
MJ/m².yr	45

Market Composite EUI	
kWh/ft².yr	1.0
MJ/m².yr	38.9

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Retail	> 100,000 ft²		Inland North
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	5.4	L/s.m²	1.07	CFM/ft²
System Static Pressure CAV	650	Pa	2.6	wg
System Static Pressure VAV	650	Pa	2.6	wg
Fan Efficiency	60%			
Fan Motor Efficiency	80%			
Sizing Factor	1.00			
Fan Design Load CAV	7.4	W/m²	0.68	W/ft²
Fan Design Load VAV	7.4	W/m²	0.68	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	80%	20%	50%	50%
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	50%	50%	50%	50%
Comments:				

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.0	L/s.m²	0.00	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.1	L/s.m²	0.02	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.1	W/m²	0.01	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.027	kW/kW	0.09	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	2.62	W/m²	0.24	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.005	L/s.m²	0.008	U.S. gpm/ft²
Pump Head Pressure	0	kPa	0	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.00	W/m²	0.00	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.004	L/s.m²	0.0061	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.8	W/m²	0.08	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	41.5	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	0.9	kWh/m².yr
Condenser Pump Energy Consumption	0.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.5	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	4.2	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI		
	kWh/ft².yr	4.4
	MJ/m².yr	169.5

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Large Retail	**> 100,000 ft²**		**Inland North**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**21.5** kWh/ft².yr	**834.5** MJ/m².yr	**Fossil Fuel**	**12.9** kWh/ft².yr	**501.6** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	4.1	158.9
ARCHITECTURAL LIGHTING	4.5	173.4
SPECIAL PURPOSE LIGHTING	2.7	104.0
OTHER PLUG LOADS	0.8	30.6
HVAC FANS & PUMPS	4.4	169.5
REFRIGERATION	0.3	10.0
COMPUTER EQUIPMENT	1.2	45.8
ELEVATORS	0.3	11.6
OUTDOOR LIGHTING	1.3	50.9

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.6	24.7	12.0	464.2
SPACE COOLING	0.7	28.7	0.0	0.0
DOMESTIC HOT WATER	0.4	16.5	0.6	22.4
FOOD SERVICE EQUIPMENT	0.3	10.0	0.3	10.0
MISCELLANEOUS	0.0	0.0	0.1	5.0

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Retail	50,000 - 100,000 ft2		Inland North
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.59	W/m².°C	0.10	Btu/hr.ft² . °F	Typical Building Size	7,435	m²	80,000	ft²
Roof U value (W/m².°C)	0.32	W/m².°C	0.06	Btu/hr.ft² . °F	Typical Footprint (m²)	7,435	m²	80,000	ft²
Glazing U value (W/m².°C)	3.50	W/m².°C	0.62	Btu/hr.ft² . °F	Footprint Aspect Ratio (L:W)	5			
					Percent Conditioned Space	100%			
					Percent Conditioned Space Defined as Exterior Zone	45%			
Window/Wall Ratio (WIWAR) (%)	0.10								
Shading Coefficient (SC)	0.78				Typical # Stories	1			
					Floor to Floor Height (m)	5.0	m	16.5	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	100%		0%		0%		0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	25	m²/person	269	ft²/person	%OA	20.40%
Occupancy Schedule Occ. Period	90%					
Occupancy Schedule Unocc. Period	0%					
Fresh Air Requirements or Outside Air	27	L/s.person	57	CFM/person		

Fresh Air Control Type *(enter a 1, 2 or 3) | 1
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right: 34%
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation: 0.5 L/s.m² | 0.10 CFM/ft² | 50% operation (%)

Sizing Factor	2			
Total Air Circulation or Design Air Flow	5.29	L/s.m²	1.04	CFM/ft²
Infiltration Rate	0.42	L/s.m²	0.08	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	2,539,502	
Peak Zone Sensible Load	896,400	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	41,700	
Total air circulation or Design air	5.29	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	21	°C	69.8	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	21	°C	69.8	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning — Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Retail	50,000 - 100,000 ft2		Inland North
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	590	Lux	54.8	ft-candles
Floor Fraction (GLFF)	0.55			
Connected Load	15.2	W/m²	1.4	W/ft²
Occ. Period(Hrs./yr.)	4100			
Unocc. Period(Hrs./yr.)	4660			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	20%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	500	600	700	800	Total
% Distribution	10%	90%	0%	0%	100%
Weighted Average					**590**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			0.0%	0%	100.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	3.8
	MJ/m².yr	146

ARCHITECTURAL LIGHTING

Light Level	575	Lux	53.4	ft-candles
Floor Fraction (ALFF)	0.15			
Connected Load	63.6	W/m²	5.9	W/ft²
Occ. Period(Hrs./yr.)	4100			
Unocc. Period(Hrs./yr.)	4660			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	35%			
Fixture Cleaning:				
Incidence of Practice	95%			
Interval	20%	years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	400	500	600	700	Total
% Distribution	0%	25%	75%	0%	100%
Weighted Average					**575**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	65%	35%					0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	4.9
	MJ/m².yr	190

SPECIAL PURPOSE LIGHTING

Light Level	550.00	Lux	51.1	ft-candles
Floor Fraction (HBLFF)	0.30			
Connected Load	23.0	W/m²	2.1	W/ft²
Occ. Period(Hrs./yr.)	4100			
Unocc. Period(Hrs./yr.)	4660			
Usage During Occupied Period	100%			
Usage During Unoccupied Period	15%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 | 1.00

Light Level (Lux)	400	500	600	700	Total
% Distribution	0%	50%	50%	0%	100%
Weighted Average					**550**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)						100%		100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.7	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	3.1
	MJ/m².yr	119

TOTAL LIGHTING

Overall LPD	17.92 W/m²	EUI TOTAL	kWh/ft².yr	11.7
	1.67 W/ft²		MJ/m².yr	454

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Servers		Plug Loads	
Measured Power (W/device)	55		51		100		200		217			
Density (device/occupant)	0.36046		0.36046		0.01		0.01		0.02			
Connected Load	0.8	W/m²	0.7	W/m²	0.0	W/m²	0.1	W/m²	0.5	W/m²	1.15	W/m²
	0.1	W/ft²	0.1	W/ft²	0.00	W/ft²	0.01	W/ft²	0.05	W/ft²	0.11	W/ft²
Diversity Occupied Period	90%		90%		90%		90%		100%		90%	
Diversity Unoccupied Period	50%		50%		50%		50%		100%		25%	
Operation Occ. Period (hrs./year)	2000		2000		2600		2600		2600		4100	
Operation Unocc. Period (hrs./year)	6760		6760		6160		6160		6160		4660	

Total end-use load (occupied period)	3.0	W/m²	0.3	W/ft²
Total end-use load (unocc. period)	1.6	W/m²	0.2	W/ft²
Usage during occupied period	100%			
Usage during unoccupied period	54%			

	EUI		
Computer Equipment	EUI	kWh/ft².yr	1.21
		MJ/m².yr	46.85
Plug Loads	EUI	kWh/ft².yr	0.52
		MJ/m².yr	20.10

FOOD SERVICE EQUIPMENT

Provide description below:

Small restaurants, food courts, kitchenettes

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	0.1	EUI	kWh/ft².yr	0.1
	MJ/m².yr	5.0		MJ/m².yr	5.0

REFRIGERATION

Provide description below:

EUI	kWh/ft².yr	0.2
	MJ/m².yr	8.6

MISCELLANEOUS

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	0.3	EUI	kWh/ft².yr	0.0
	MJ/m².yr	10.0		MJ/m².yr	0.0

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Retail	50,000 - 100,000 ft2		Inland North
Baseline			

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	0%	2%	0%	60%	30%	0%	3%	0%	5%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff. (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	35.9	W/m²	11.4	Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	328	MJ/m².yr	8.5	kWh/ft².yr
Sizing Factor	1.00			
Electric Fuel Share	8.0%	Fossil Fuel Share	92.0%	

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	7.2
MJ/m².yr	277

Gas EUI	
kWh/ft².yr	11.0
MJ/m².yr	428

Market Composite EUI	
kWh/ft².yr	10.7
MJ/m².yr	416

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	0.0%	3.0%	0.0%	3.0%	94.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7	°C	44.6	°F
Condenser Water	30	°C	86	°F
Supply Air	14.0	°C	57.2	°F

Peak Cooling Load	100	W/m²	32	Btu/hr.ft²	378	ft²/Ton
Seasonal Cooling Load (Tertiary Load)	99.4	MJ/m².yr	2.6	kWh/ft².yr		

Sizing Factor 1.00   Operation (occ. period) 3000 hrs/year   Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C) 90.0%

Electric Fuel Share 100.0%   Gas Fuel Share 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenan

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	1.1
MJ/m².yr	44

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	1.1
MJ/m².yr	44

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	35%				10%
Eff./COP	0.65				0.75

	Fossil		Elec. Res.
Fuel Share	45%		55%
Blended Efficiency	0.67		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 30.0

Wetting Use Percentage 90%

All Electric EUI	
kWh/ft².yr	0.9
MJ/m².yr	33

Fossil Fuel EUI	
kWh/ft².yr	1.2
MJ/m².yr	45

Market Composite EUI	
kWh/ft².yr	1.0
MJ/m².yr	38.2

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Medium Retail	**50,000 - 100,000 ft2**		**Inland North**
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	5.3	L/s.m²	1.04	CFM/ft²
System Static Pressure CAV	500	Pa	2.0	wg
System Static Pressure VAV	500	Pa	2.0	wg
Fan Efficiency	60%			
Fan Motor Efficiency	88%			
Sizing Factor	1.00			
Fan Design Load CAV	5.0	W/m²	0.47	W/ft²
Fan Design Load VAV	5.0	W/m²	0.47	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	100%	0%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	75%	25%	50%	50%
Comments:				

EXHAUST FANS

Washroom Exhaust	50	L/s.washroom	106	CFM/washroom
Washroom Exhaust per gross unit are	0.0	L/s.m²	0.00	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.1	L/s.m²	0.02	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.2	W/m²	0.01	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.020	kW/kW	0.07	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	2.00	W/m²	0.19	W/ft²

Condenser Pump

Pump Design Flow	0.000	L/s.KW	0.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.000	L/s.m²	0.000	U.S. gpm/ft²
Pump Head Pressure	45	kPa	15	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.00	W/m²	0.00	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.004	L/s.m²	0.0063	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	0	kPa	0	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.0	W/m²	0.00	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	37.3	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	0.9	kWh/m².yr
Condenser Pump Energy Consumption	0.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.5	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	0.0	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI	kWh/ft².yr	3.6
	MJ/m².yr	139.6

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Medium Retail	**50,000 - 100,000 ft2**		**Inland North**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**21.1** kWh/ft².yr	**816.9** MJ/m².yr	**Fossil Fue**	**11.1** kWh/ft².yr	**428.4** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	3.8	145.7
ARCHITECTURAL LIGHTING	4.9	189.8
SPECIAL PURPOSE LIGHTING	3.1	119.0
OTHER PLUG LOADS	0.5	20.1
HVAC FANS & PUMPS	3.6	139.6
REFRIGERATION	0.2	8.6
COMPUTER EQUIPMENT	1.2	46.9
ELEVATORS	0.3	11.6
OUTDOOR LIGHTING	1.3	50.9

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.6	22.2	10.2	393.4
SPACE COOLING	1.0	39.4	0.0	0.0
DOMESTIC HOT WATER	0.5	18.1	0.5	20.1
FOOD SERVICE EQUIPMENT	0.1	5.0	0.1	5.0
MISCELLANEOUS	0.0	0.0	0.3	10.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Food Retail	0		Inland North
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.64	W/m².°C	0.11	Btu/hr.ft² . °F	Typical Building Size	4,000	m²	43,040	ft²
Roof U value (W/m².°C)	0.34	W/m².°C	0.06	Btu/hr.ft² . °F	Typical Footprint (m²)	4,000	m²	43,040	ft²
Glazing U value (W/m².°C)	3.50	W/m².°C	0.62	Btu/hr.ft² . °F	Footprint Aspect Ratio (L:W)	1			
					Percent Conditioned Space	100%			
					Percent Conditioned Space Defined as Exterior Zone	40%			
Window/Wall Ratio (WIWAR) (%)	0.11								
Shading Coefficient (SC)	0.79				Typical # Stories	1			
					Floor to Floor Height (m)	7.0	m	23.0	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	100%		0%		0%		0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	45	m²/person	484	ft²/person	%OA	22.65%
Occupancy Schedule Occ. Period	90%					
Occupancy Schedule Unocc. Period	0%					
Fresh Air Requirements or Outside Air	50	L/s.person	106	CFM/person		

Fresh Air Control Type *(enter a 1, 2 or 3)	1	If Fresh Air Control Type = "2" enter % FA. to the right:	0%			
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)		If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation	0.5	L/s.m²	0.10	CFM/ft²
			50%	operation (%)		

Sizing Factor	1.65			
Total Air Circulation or Design Air Flow	4.91	L/s.m²	0.97	CFM/ft²
Infiltration Rate	0.32	L/s.m²	0.06	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	1,433,686	
Peak Zone Sensible Load	541,610	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	25,196	
Total air circulation or Design air	4.91	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	22	°C	71.6	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	20.4	°C	68.72	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning — Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Food Retail	0		Inland North
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	600	Lux	55.8	ft-candles
Floor Fraction (GLFF)	0.40			
Connected Load	15.5	W/m²	1.4	W/ft²

Occ. Period(Hrs./yr.)	4100	
Unocc. Period(Hrs./yr.)	4660	
Usage During Occupied Period	100%	
Usage During Unoccupied Period	40%	
Fixture Cleaning:		
Incidence of Practice		
Interval		years
Relamping Strategy & Incidence of Practice	Group	Spot

Light Level (Lux)	500	600	700	800				Total
% Distribution	25%	50%	25%	0%				100%
Weighted Average								**600**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)					100.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	3.4
	MJ/m².yr	133

ARCHITECTURAL LIGHTING

Light Level	640	Lux	59.5	ft-candles
Floor Fraction (ALFF)	0.20			
Connected Load	47.8	W/m²	4.4	W/ft²

Occ. Period(Hrs./yr.)	4100	
Unocc. Period(Hrs./yr.)	4660	
Usage During Occupied Period	100%	
Usage During Unoccupied Period	50%	
Fixture Cleaning:		
Incidence of Practice		
Interval		years
Relamping Strategy & Incidence of Practice	Group	Spot

Light Level (Lux)	300	500	700	1000				Total
% Distribution	0%	30%	70%	0%				100%
Weighted Average								**640**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	30%	70%						100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	5.7
	MJ/m².yr	221

SPECIAL PURPOSE LIGHTING

Light Level	500.00	Lux	46.5	ft-candles
Floor Fraction (HBLFF)	0.40			
Connected Load	23.3	W/m²	2.2	W/ft²

Floor fraction check: should = 1.00 | 1.00

Occ. Period(Hrs./yr.)	4100	
Unocc. Period(Hrs./yr.)	4660	
Usage During Occupied Period	100%	
Usage During Unoccupied Period	50%	
Fixture Cleaning:		
Incidence of Practice		
Interval		years
Relamping Strategy & Incidence of Practice	Group	Spot

Light Level (Lux)	300	500	700	1000				Total
% Distribution	20%	60%	20%	0%				100%
Weighted Average								**500**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)						100%		100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	5.6
	MJ/m².yr	216

TOTAL LIGHTING

Overall LPD	15.76 W/m²	EUI TOTAL	kWh/ft².yr	14.7
	1.47 W/ft²		MJ/m².yr	570

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Servers		Plug Loads	
Measured Power (W/device)	55		51		100		200		217			
Density (device/occupant)	0.648828		0.648828		0.01		0.01		0.03			
Connected Load	0.8	W/m²	0.7	W/m²	0.0	W/m²	0.0	W/m²	0.5	W/m²	2.85	W/m²
	0.1	W/ft²	0.1	W/ft²	0.00	W/ft²	0.00	W/ft²	0.05	W/ft²	0.26	W/ft²
Diversity Occupied Period	90%		90%		90%		90%		100%		90%	
Diversity Unoccupied Period	50%		50%		50%		50%		100%		50%	
Operation Occ. Period (hrs./year)	2000		2000		2600		2600		2600		4100	
Operation Unocc. Period (hrs./year)	6760		6760		6160		6160		6160		4660	

Total end-use load (occupied period)	4.5	W/m²	0.4	W/ft²
Total end-use load (unocc. period)	2.7	W/m²	0.3	W/ft²
Usage during occupied period	100%			
Usage during unoccupied period	61%			

Computer Equipment	EUI	kWh/ft².yr	1.18
		MJ/m².yr	45.81
Plug Loads	EUI	kWh/ft².yr	1.59
		MJ/m².yr	61.77

FOOD SERVICE EQUIPMENT

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	2.3	EUI	kWh/ft².yr	0.4
	MJ/m².yr	90.0		MJ/m².yr	15.0

REFRIGERATION

Provide description below:

Commercial refrigeration display cases

EUI	kWh/ft².yr	29.0
	MJ/m².yr	1125.0

MISCELLANEOUS

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	0.5	EUI	kWh/ft².yr	0.0
	MJ/m².yr	20.0		MJ/m².yr	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Food Retail	0		Inland North
Baseline			

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	3%	10%	2%	65%	10%	0%	4%	1%	5%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff. (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	49.3	W/m²	15.7	Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	534	MJ/m².yr	13.8	kWh/ft².yr
Sizing Factor	1.00			
Electric Fuel Share	10.0%	Fossil Fuel Share	90.0%	

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	10.6
MJ/m².yr	410

Gas EUI	
kWh/ft².yr	18.1
MJ/m².yr	699

Market Composite EUI	
kWh/ft².yr	17.3
MJ/m².yr	671

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	0.0%	0.0%	0.0%		100.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7	°C	44.6	°F
Condenser Water	30	°C	86	°F
Supply Air	14.0	°C	57.2	°F

Peak Cooling Load	105	W/m²	33	Btu/hr.ft²	360	ft²/Ton
Seasonal Cooling Load (Tertiary Load)	102.3	MJ/m².yr	2.6	kWh/ft².yr		

Sizing Factor 1.00   Operation (occ. period) 3000 hrs/year   Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C) 85.0%

Electric Fuel Share 100.0%   Gas Fuel Share 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenan

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	1.0
MJ/m².yr	40

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	1.0
MJ/m².yr	40

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	60%				5%
Eff./COP	0.65				0.75

	Fossil		Elec. Res.
Fuel Share	65%		35%
Blended Efficiency	0.66		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 65.0

Wetting Use Percentage 90%

All Electric EUI	
kWh/ft².yr	1.8
MJ/m².yr	71

Fossil Fuel EUI	
kWh/ft².yr	2.6
MJ/m².yr	99

Market Composite EUI	
kWh/ft².yr	2.3
MJ/m².yr	89.2

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Food Retail	0		Inland North
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	4.9	L/s.m²	0.97	CFM/ft²
System Static Pressure CAV	500	Pa	2.0	wg
System Static Pressure VAV	1000	Pa	4.0	wg
Fan Efficiency	60%			
Fan Motor Efficiency	80%			
Sizing Factor	1.00			
Fan Design Load CAV	5.1	W/m²	0.47	W/ft²
Fan Design Load VAV	10.2	W/m²	0.95	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	100%	0%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	40%	60%	100%	0%

Comments:

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m²	0.01	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.2	L/s.m²	0.03	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.2	W/m²	0.02	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.027	kW/kW	0.09	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	2.84	W/m²	0.26	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.006	L/s.m²	0.008	U.S. gpm/ft²
Pump Head Pressure	0	kPa	0	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.00	W/m²	0.00	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.005	L/s.m²	0.0067	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	0	kPa	0	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.0	W/m²	0.00	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	28.6	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	1.8	kWh/m².yr
Condenser Pump Energy Consumption	0.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.7	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	0.0	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI	kWh/ft².yr	2.9
	MJ/m².yr	111.8

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Food Retail	**0**		**Inland North**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**53.6**	kWh/ft².yr	**2,075.3**	MJ/m².yr	**Fossil Fue**	**20.7** kWh/ft².yr	**803.7** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	3.4	133.1
ARCHITECTURAL LIGHTING	5.7	221.4
SPECIAL PURPOSE LIGHTING	5.6	215.8
OTHER PLUG LOADS	1.6	61.8
HVAC FANS & PUMPS	2.9	111.8
REFRIGERATION	29.0	1,125.0
COMPUTER EQUIPMENT	1.2	45.8
ELEVATORS	0.3	11.6
OUTDOOR LIGHTING	0.9	33.9

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	1.1	41.0	16.3	629.5
SPACE COOLING	0.9	34.0	0.0	0.0
DOMESTIC HOT WATER	0.6	25.0	1.7	64.2
FOOD SERVICE EQUIPMENT	0.4	15.0	2.3	90.0
MISCELLANEOUS	0.0	0.0	0.5	20.0

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Large Hotel	**0**		**Inland North**
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.82 W/m².°C	0.14 Btu/hr.ft² . °F	Typical Building Size	20,000 m²	215,200 ft²
Roof U value (W/m².°C)	0.34 W/m².°C	0.06 Btu/hr.ft² . °F	Typical Footprint (m²)	2,000 m²	21,520 ft²
Glazing U value (W/m².°C)	3.50 W/m².°C	0.62 Btu/hr.ft² . °F	Footprint Aspect Ratio (L:W)	3	
			Percent Conditioned Space	100%	
			Percent Conditioned Space Defined as Exterior Zone	45%	
Window/Wall Ratio (WIWAR) (%)	0.30				
Shading Coefficient (SC)	0.65		Typical # Stories	10	
			Floor to Floor Height (m)	3.7 m	12.0 ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	66%		0%		0%	34%	0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	60 m²/person	646 ft²/person	%OA 24.77%
Occupancy Schedule Occ. Period	45%		
Occupancy Schedule Unocc. Period	80%		
Fresh Air Requirements or Outside Air	55 L/s.person	117 CFM/person	

Fresh Air Control Type *(enter a 1, 2 or 3) 1
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right: 15%
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation 0.5 L/s.m² 0.10 CFM/ft²
50% operation (%)

Sizing Factor	1.6	
Total Air Circulation or Design Air Flow	3.70 L/s.m²	0.73 CFM/ft²
Infiltration Rate	0.38 L/s.m²	0.07 CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0 L/s.m²	0.00 CFM/ft²
Operation occupied period	50%	
Operation unoccupied period	50%	

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	5,741,199	
Peak Zone Sensible Load	2,107,286	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	98,031	
Total air circulation or Design air	3.70	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	23	°C	73.4	°F	15	°C	59	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	20.6	°C	69.08	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Hotel	0		Inland North
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	248	Lux	23.0	ft-candles
Floor Fraction (GLFF)	0.20			
Connected Load	6.4	W/m²	0.6	W/ft²
Occ. Period(Hrs./yr.)	3000			
Unocc. Period(Hrs./yr.)	5760			
Usage During Occupied Period	85%			
Usage During Unoccupied Period	90%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	125	300	400	500				Total
% Distribution	30%	70%						100%
Weighted Average								**247.5**
	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			0.0%		100.0%			100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	0.9
	MJ/m².yr	36

ARCHITECTURAL LIGHTING

Light Level	220	Lux	20.4	ft-candles
Floor Fraction (ALFF)	0.80			
Connected Load	15.3	W/m²	1.4	W/ft²
Occ. Period(Hrs./yr.)	2500			
Unocc. Period(Hrs./yr.)	6260			
Usage During Occupied Period	60%			
Usage During Unoccupied Period	40%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	100	200	300	400				Total
% Distribution	20%	50%	20%	10%				100%
Weighted Average								**220**
	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	25%	75%						100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	4.6
	MJ/m².yr	177

SPECIAL PURPOSE LIGHTING

Light Level	0.00	Lux	0.0	ft-candles
Floor Fraction (HBLFF)	0.00			
Connected Load	0.0	W/m²	0.0	W/ft²
Occ. Period(Hrs./yr.)	4000			
Unocc. Period(Hrs./yr.)	4760			
Usage During Occupied Period	0%			
Usage During Unoccupied Period	100%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 | 1.00

Light Level (Lux)	300	500	700	1000				Total
% Distribution		0%	0%	0%				0%
Weighted Average								**0**
	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)								0.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	0.0
	MJ/m².yr	0

TOTAL LIGHTING

Overall LPD	13.53 W/m²	EUI TOTAL	kWh/ft².yr	5.5
	1.26 W/ft²		MJ/m².yr	212

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Servers		Plug Loads	
Measured Power (W/device)	55		51		100		200		217			
Density (device/occupant)	0.3		0.3		0.05		0.033		0.03			
Connected Load	0.3	W/m²	0.3	W/m²	0.1	W/m²	0.1	W/m²	0.5	W/m²	2.2	W/m²
	0.0	W/ft²	0.0	W/ft²	0.01	W/ft²	0.01	W/ft²	0.05	W/ft²	0.20	W/ft²
Diversity Occupied Period	90%		90%		90%		90%		100%		70%	
Diversity Unoccupied Period	50%		50%		50%		50%		100%		25%	
Operation Occ. Period (hrs./year)	2500		2500		2500		2500		2500		3000	
Operation Unocc. Period (hrs./year)	6260		6260		6260		6260		6260		5760	

Total end-use load (occupied period)	2.7	W/m²	0.3	W/ft²
Total end-use load (unocc. period)	1.4	W/m²	0.1	W/ft²
Usage during occupied period	100%			
Usage during unoccupied period	53%			

Computer Equipment	EUI	kWh/ft².yr	0.78
		MJ/m².yr	30.14
Plug Loads	EUI	kWh/ft².yr	0.72
		MJ/m².yr	28.04

FOOD SERVICE EQUIPMENT

Provide description below:

Commercial food preparation

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	2.6	EUI	kWh/ft².yr	0.5
	MJ/m².yr	100.0		MJ/m².yr	17.5

REFRIGERATION

Provide description below:

Walk-in coolers/freezers, reach-in coolers/freezers, refrigerated buffet cases

EUI	kWh/ft².yr	0.6
	MJ/m².yr	25.0

MISCELLANEOUS

Provide description below:

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	1.5	EUI	kWh/ft².yr	0.0
	MJ/m².yr	60.0		MJ/m².yr	0.0

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Hotel	0		Inland North
Baseline			

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	5%	55%	10%	15%	0%	0%	5%	2%	8%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff. (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	42.0 W/m²	13.3 Btu/hr.ft²	
Seasonal Heating Load (Tertiary Load)	478 MJ/m².yr	12.3 kWh/ft².yr	
Sizing Factor	1.00		
Electric Fuel Share	15.0%	Fossil Fuel Share	85.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	9.5
MJ/m².yr	370

Gas EUI	
kWh/ft².yr	15.5
MJ/m².yr	599

Market Composite EUI	
kWh/ft².yr	14.6
MJ/m².yr	565

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	0.0%	33.3%	0.0%	33.3%	33.4%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7 °C	44.6 °F
Condenser Water	30 °C	86 °F
Supply Air	15.0 °C	59 °F

Peak Cooling Load	76 W/m²	24 Btu/hr.ft²	500 ft²/Ton
Seasonal Cooling Load (Tertiary Load)	98.6 MJ/m².yr	2.5 kWh/ft².yr	

Sizing Factor: 0.90 — Operation (occ. period): 3000 hrs/year — Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C): 80.0%

Electric Fuel Share: 100.0% — Gas Fuel Share: 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	1.0
MJ/m².yr	39

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	1.0
MJ/m².yr	39

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	20%				60%
Eff./COP	0.65				0.75

	Fossil	Elec. Res.
Fuel Share	80%	20%
Blended Efficiency	0.73	0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load): 225.0

Wetting Use Percentage: 90%

All Electric EUI	
kWh/ft².yr	6.4
MJ/m².yr	247

Fossil Fuel EUI	
kWh/ft².yr	8.0
MJ/m².yr	310

Market Composite EUI	
kWh/ft².yr	7.7
MJ/m².yr	297.7

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Hotel	0		Inland North
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	3.7	L/s.m²	0.73	CFM/ft²
System Static Pressure CAV	500	Pa	2.0	wg
System Static Pressure VAV	750	Pa	3.0	wg
Fan Efficiency	60%			
Fan Motor Efficiency	70%			
Sizing Factor	1.00			
Fan Design Load CAV	4.4	W/m²	0.41	W/ft²
Fan Design Load VAV	6.6	W/m²	0.61	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	66%	0%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	75%	25%	100%	0%

Comments:

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m²	0.02	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.2	L/s.m²	0.04	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.3	W/m²	0.02	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.023	kW/kW	0.08	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	1.73	W/m²	0.16	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.004	L/s.m²	0.006	U.S. gpm/ft²
Pump Head Pressure	45	kPa	15	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.45	W/m²	0.04	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.003	L/s.m²	0.0048	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.7	W/m²	0.06	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	21.7	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	2.3	kWh/m².yr
Condenser Pump Energy Consumption	0.8	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.6	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	3.3	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI		
	kWh/ft².yr	2.7
	MJ/m².yr	103.1

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Large Hotel	**0**		**Inland North**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**15.1** kWh/ft².yr	**584.3** MJ/m².yr	**Fossil Fue**	**23.7** kWh/ft².yr	**917.4** MJ/m².yr		

END USE:	kWh/ft².yr	MJ/m².yr	**END USE:**	Electricity		Fossil Fuel	
GENERAL LIGHTING	0.9	35.6		kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
ARCHITECTURAL LIGHTING	4.6	176.6	SPACE HEATING	1.4	55.5	13.1	509.2
SPECIAL PURPOSE LIGHTING	0.0	0.0	SPACE COOLING	0.8	31.5	0.0	0.0
OTHER PLUG LOADS	0.7	28.0	DOMESTIC HOT WATER	1.3	49.5	6.4	248.3
HVAC FANS & PUMPS	2.7	103.1	FOOD SERVICE EQUIPMENT	0.5	17.5	2.6	100.0
REFRIGERATION	0.6	25.0	MISCELLANEOUS	0.0	0.0	1.5	60.0
COMPUTER EQUIPMENT	0.8	30.1					
ELEVATORS	0.3	11.6					
OUTDOOR LIGHTING	0.5	20.4					

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: Medium Hotel, Baseline
SIZE: 50,000 to 100,000 ft²
VINTAGE:
REGION: Inland North

CONSTRUCTION

Wall U value (W/m².°C)	0.78	W/m².°C	0.14	Btu/hr.ft² . °F
Roof U value (W/m².°C)	0.33	W/m².°C	0.06	Btu/hr.ft² . °F
Glazing U value (W/m².°C)	3.50	W/m².°C	0.62	Btu/hr.ft² . °F
Window/Wall Ratio (WIWAR) (%)	0.40			
Shading Coefficient (SC)	0.57			

Typical Building Size	6,000	m²	64,560	ft²
Typical Footprint (m²)	1,500	m²	16,140	ft²
Footprint Aspect Ratio (L:W)	4			
Percent Conditioned Space	100%			
Percent Conditioned Space Defined as Exterior Zone	45%			
Typical # Stories	4			
Floor to Floor Height (m)	3.7	m	12.0	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	66%		0%		0%	34%	0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	50	m²/person	538	ft²/person
Occupancy Schedule Occ. Period	50%			
Occupancy Schedule Unocc. Period	80%			
Fresh Air Requirements or Outside Air	40	L/s.person	85	CFM/person

%OA 19.95%

Fresh Air Control Type *(enter a 1, 2 or 3) 1
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right: 15%
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation 0.5 L/s.m² 0.10 CFM/ft²
50% operation (%)

Sizing Factor	1.4			
Total Air Circulation or Design Air Flow	4.01	L/s.m²	0.79	CFM/ft²
Infiltration Rate	0.50	L/s.m²	0.10	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	1,739,533	
Peak Zone Sensible Load	782,822	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	36,417	
Total air circulation or Design air	4.01	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	22	°C	71.6	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	21	°C	69.8	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Medium Hotel	**50,000 to 100,000 ft²**		**Inland North**
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	239	Lux	22.2	ft-candles
Floor Fraction (GLFF)	0.20			
Connected Load	6.2	W/m²	0.6	W/ft²

Occ. Period(Hrs./yr.)	3000
Unocc. Period(Hrs./yr.)	5760
Usage During Occupied Period	75%
Usage During Unoccupied Period	75%

	125	300	700	1000				Total
Light Level (Lux)	125	300	700	1000				Total
% Distribution	35%	65%	0%	0%				100%
Weighted Average								**238.75**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)					100.0%			100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

Fixture Cleaning:
  Incidence of Practice
  Interval years

Relamping Strategy & Incidence of Practice: Group / Spot

EUI	kWh/ft².yr	0.8
	MJ/m².yr	29

ARCHITECTURAL LIGHTING

Light Level	151	Lux	14.1	ft-candles
Floor Fraction (ALFF)	0.80			
Connected Load	11.8	W/m²	1.1	W/ft²

Occ. Period(Hrs./yr.)	2100
Unocc. Period(Hrs./yr.)	6660
Usage During Occupied Period	45%
Usage During Unoccupied Period	60%

Light Level (Lux)	100	125	150	300				Total
% Distribution	0%	85%	0%	15%				100%
Weighted Average								**151.25**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	33%	67%						100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

Fixture Cleaning:
Incidence of Practice
Interval years

Relamping Strategy & Incidence of Practice: Group / Spot

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	4.3
	MJ/m².yr	167

SPECIAL PURPOSE LIGHTING

Light Level	0.00	Lux	0.0	ft-candles
Floor Fraction (HBLFF)	0.00			
Connected Load	0.0	W/m²	0.0	W/ft²

Floor fraction check: should = 1.00 | 1.00

Occ. Period(Hrs./yr.)	4000
Unocc. Period(Hrs./yr.)	4760
Usage During Occupied Period	0%
Usage During Unoccupied Period	100%

Light Level (Lux)	300	500	700	1000				Total
% Distribution		0%	0%	0%				0%
Weighted Average								**0**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)								0.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

Fixture Cleaning:
Incidence of Practice
Interval years

Relamping Strategy & Incidence of Practice: Group / Spot

EUI	kWh/ft².yr	0.0
	MJ/m².yr	0

TOTAL LIGHTING

Overall LPD	10.65 W/m²	EUI TOTAL	kWh/ft².yr	5.1
	0.99 W/ft²		MJ/m².yr	197

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Servers		Plug Loads	
Measured Power (W/device)	55		51		100		200		217			
Density (device/occupant)	0.3		0.3		0.05		0.033		0.03			
Connected Load	0.3	W/m²	0.3	W/m²	0.1	W/m²	0.1	W/m²	0.5	W/m²	2.1	W/m²
	0.0	W/ft²	0.0	W/ft²	0.01	W/ft²	0.01	W/ft²	0.05	W/ft²	0.20	W/ft²
Diversity Occupied Period	90%		90%		90%		90%		100%		70%	
Diversity Unoccupied Period	50%		50%		50%		50%		100%		25%	
Operation Occ. Period (hrs./year)	2500		2500		2500		2500		2500		3000	
Operation Unocc. Period (hrs./year)	6260		6260		6260		6260		6260		5760	

Total end-use load (occupied period)	2.8	W/m²	0.3	W/ft²
Total end-use load (unocc. period)	1.5	W/m²	0.1	W/ft²

Usage during occupied period	100%
Usage during unoccupied period	53%

Computer Equipment	EUI	kWh/ft².yr	0.85
		MJ/m².yr	32.93
Plug Loads	EUI	kWh/ft².yr	0.69
		MJ/m².yr	26.76

FOOD SERVICE EQUIPMENT

Provide description below:

Kitchen services

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	1.5	EUI	kWh/ft².yr	1.0
	MJ/m².yr	60.0		MJ/m².yr	40.0

REFRIGERATION

Provide description below:

Walk-in coolers/freezers, reach-in coolers/freezers, refrigerated buffet cases

EUI	kWh/ft².yr	0.6
	MJ/m².yr	25.0

MISCELLANEOUS

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	1.5	EUI	kWh/ft².yr	0.0
	MJ/m².yr	60.0		MJ/m².yr	0.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Hotel	50,000 to 100,000 ft²		Inland North
Baseline			

SPACE HEATING

Heating Plant Type

							Electric			Other	
				Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	5%	5%	5%	45%	0%	0%	2%	0%	38%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff. (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	61.7 W/m²	19.6 Btu/hr.ft²	
Seasonal Heating Load (Tertiary Load)	510 MJ/m².yr	13.2 kWh/ft².yr	
Sizing Factor	1.00		
Electric Fuel Share	40.0%	Fossil Fuel Share	60.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	12.9
MJ/m².yr	499

Gas EUI	
kWh/ft².yr	17.2
MJ/m².yr	666

Market Composite EUI	
kWh/ft².yr	15.5
MJ/m².yr	600

SPACE COOLING

A/C Plant Type

			WSHP			Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	0.0%	0.0%	0.0%	25.0%	75.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7 °C	44.6 °F
Condenser Water	30 °C	86 °F
Supply Air	14.0 °C	57.2 °F

Peak Cooling Load	72 W/m²	23 Btu/hr.ft²	524 ft²/Ton
Seasonal Cooling Load (Tertiary Load)	107.3 MJ/m².yr	2.8 kWh/ft².yr	

Sizing Factor: 0.85 — Operation (occ. period): 3000 hrs/year — Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C): 60.0%

Electric Fuel Share: 100.0% — Gas Fuel Share: 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	1.2
MJ/m².yr	47

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	1.2
MJ/m².yr	47

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Std. Tank	PV Tank	Cond. Tnk	Std. Boiler	Cnd. Boil.
System Present (%)	40%				30%
Eff./COP	0.65				0.75

	Fossil	Elec. Res.
Fuel Share	70%	30%
Blended Efficiency	0.69	0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load): 225.0

Wetting Use Percentage: 90%

All Electric EUI	
kWh/ft².yr	6.4
MJ/m².yr	247

Fossil Fuel EUI	
kWh/ft².yr	8.4
MJ/m².yr	325

Market Composite EUI	
kWh/ft².yr	7.8
MJ/m².yr	301.5

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Medium Hotel	**50,000 to 100,000 ft²**		**Inland North**
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	4.0	L/s.m²	0.79	CFM/ft²
System Static Pressure CAV	250	Pa	1.0	wg
System Static Pressure VAV	250	Pa	1.0	wg
Fan Efficiency	45%			
Fan Motor Efficiency	70%			
Sizing Factor	1.00			
Fan Design Load CAV	3.2	W/m²	0.30	W/ft²
Fan Design Load VAV	3.2	W/m²	0.30	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	66%	0%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	80%	20%	100%	0%
Comments:				

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m²	0.03	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.2	L/s.m²	0.05	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.3	W/m²	0.03	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.027	kW/kW	0.09	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	1.95	W/m²	0.18	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.004	L/s.m²	0.006	U.S. gpm/ft²
Pump Head Pressure	45	kPa	15	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.43	W/m²	0.04	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.003	L/s.m²	0.0046	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.6	W/m²	0.06	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	16.2	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	2.7	kWh/m².yr
Condenser Pump Energy Consumption	0.9	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.8	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	3.1	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI	kWh/ft².yr	2.2
	MJ/m².yr	85.5

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Hotel	50,000 to 100,000 ft²		Inland North
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	Electricity:	19.0 kWh/ft².yr	737.3 MJ/m².yr	Fossil Fuel	19.3 kWh/ft².yr	747.2 MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	0.8	29.2
ARCHITECTURAL LIGHTING	4.3	167.5
SPECIAL PURPOSE LIGHTING	0.0	0.0
OTHER PLUG LOADS	0.7	26.8
HVAC FANS & PUMPS	2.2	85.5
REFRIGERATION	0.6	25.0
COMPUTER EQUIPMENT	0.9	32.9
ELEVATORS	0.3	11.6
OUTDOOR LIGHTING	0.4	17.0

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	5.2	199.6	10.3	399.9
SPACE COOLING	0.7	28.1	0.0	0.0
DOMESTIC HOT WATER	1.9	74.2	5.9	227.3
FOOD SERVICE EQUIPMENT	1.0	40.0	1.5	60.0
MISCELLANEOUS	0.0	0.0	1.5	60.0

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Hospital	**0**		**Inland North**
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.63	W/m².°C	0.11	Btu/hr.ft² . °F	Typical Building Size	14,000	m²	150,640	ft²
Roof U value (W/m².°C)	0.34	W/m².°C	0.06	Btu/hr.ft² . °F	Typical Footprint (m²)	1,400	m²	15,064	ft²
Glazing U value (W/m².°C)	3.50	W/m².°C	0.62	Btu/hr.ft² . °F	Footprint Aspect Ratio (L:W)	2			
					Percent Conditioned Space	100%			
					Percent Conditioned Space Defined as Exterior Zone	45%			
Window/Wall Ratio (WIWAR) (%)	0.20								
Shading Coefficient (SC)	0.66				Typical # Stories	8			
					Floor to Floor Height (m)	4.3	m	14.0	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	50%		0%		20%	30%	0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	30	m²/person	323	ft²/person	%OA 37.88%
Occupancy Schedule Occ. Period	90%				
Occupancy Schedule Unocc. Period	75%				
Fresh Air Requirements or Outside Air	57	L/s.person	121	CFM/person	

Fresh Air Control Type *(enter a 1, 2 or 3) | 1 | If Fresh Air Control Type = "2" enter % FA. to the right: | 15%

(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air) | If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation | 0.5 L/s.m² | 0.10 CFM/ft²

50% operation (%)

Sizing Factor	2.3			
Total Air Circulation or Design Air Flow	5.02	L/s.m²	0.99	CFM/ft²
Infiltration Rate	0.32	L/s.m²	0.06	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based	Total
Incidence of Use	0%		100%	100%
Switchover Point		KJ/kg.	18 °C	
		Btu/lbm	64.4 °F	

Summary of Design Parameters		
Peak Design Cooling Load	5,649,757	
Peak Zone Sensible Load	1,390,492	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	64,686	
Total air circulation or Design air	5.02	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	24	°C	75.2	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	22	°C	71.6	°F	16	°C	60.8	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	22	°C	71.6	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning — Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Hospital	0		Inland North
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	475	Lux	44.1	ft-candles
Floor Fraction (GLFF)	0.95			
Connected Load	12.3	W/m²	1.1	W/ft²
Occ. Period(Hrs./yr.)	3100			
Unocc. Period(Hrs./yr.)	5660			
Usage During Occupied Period	80%			
Usage During Unoccupied Period	35%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	100	250	700	800	Total
% Distribution		50%	50%	0%	100%
Weighted Average					**475**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)					100.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI kWh/ft².yr 4.8; MJ/m².yr 187

ARCHITECTURAL LIGHTING

Light Level	250	Lux	23.2	ft-candles
Floor Fraction (ALFF)	0.05			
Connected Load	21.2	W/m²	2.0	W/ft²
Occ. Period(Hrs./yr.)	4000			
Unocc. Period(Hrs./yr.)	4760			
Usage During Occupied Period	90%			
Usage During Unoccupied Period	75%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	200	300	500	700	Total
% Distribution	50%	50%	0%	0%	100%
Weighted Average					**250**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	40%	60%						100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI kWh/ft².yr 0.7; MJ/m².yr 27

EUI = Load X Hrs. X SF X GLFF

SPECIAL PURPOSE LIGHTING

Light Level	0.00	Lux	0.0	ft-candles
Floor Fraction (HBLFF)	0.00			
Connected Load	0.0	W/m²	0.0	W/ft²
Occ. Period(Hrs./yr.)	4000			
Unocc. Period(Hrs./yr.)	4760			
Usage During Occupied Period	0%			
Usage During Unoccupied Period	100%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 — 1.00

Light Level (Lux)	300	500	700	1000	Total
% Distribution		0%	0%	0%	0%
Weighted Average					**0**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)								0.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI kWh/ft².yr 0.0; MJ/m².yr 0

TOTAL LIGHTING

Overall LPD 12.72 W/m²; 1.18 W/ft²

EUI TOTAL kWh/ft².yr 5.5; MJ/m².yr 215

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Servers	Plug Loads
Measured Power (W/device)	55	51	100	200	217	
Density (device/occupant)	0.477744	0.477744	0.02	0.02	0.04	
Connected Load	0.9 W/m²	0.8 W/m²	0.1 W/m²	0.1 W/m²	0.5 W/m²	3.85 W/m²
	0.1 W/ft²	0.1 W/ft²	0.01 W/ft²	0.01 W/ft²	0.05 W/ft²	0.36 W/ft²
Diversity Occupied Period	90%	90%	90%	90%	100%	90%
Diversity Unoccupied Period	50%	50%	50%	50%	100%	25%
Operation Occ. Period (hrs./year)	2000	2000	2600	2600	2600	4100
Operation Unocc. Period (hrs./year)	6760	6760	6160	6160	6160	4660

Total end-use load (occupied period)	5.7 W/m²	0.5 W/ft²
Total end-use load (unocc. period)	2.4 W/m²	0.2 W/ft²
Usage during occupied period	100%	
Usage during unoccupied period	43%	

		kWh/ft².yr	MJ/m².yr
Computer Equipment	EUI	1.33	51.37
Plug Loads	EUI	1.74	67.29

FOOD SERVICE EQUIPMENT

Provide description below:

Commercial food services

	Gas EUI	Electric EUI
EUI kWh/ft².yr	1.8	0.1
MJ/m².yr	70.0	2.0

REFRIGERATION

Provide description below:

Walk-in coolers/freezers, reach-in coolers/freezers, refrigerated buffet cases

EUI kWh/ft².yr 0.4; MJ/m².yr 15.0

MISCELLANEOUS

Provide description below:

	Gas EUI	Electric EUI
EUI kWh/ft².yr	6.5	0.0
MJ/m².yr	250.0	

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Hospital	0		Inland North
Baseline			

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	10%	75%	8%	5%	0%	0%	0%	0%	2%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff. (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	45.4	W/m²	14.4	Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	1499	MJ/m².yr	38.7	kWh/ft².yr
Sizing Factor	1.00			
Electric Fuel Share	2.0%	Fossil Fuel Share	98.0%	

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	38.7
MJ/m².yr	1499

Gas EUI	
kWh/ft².yr	48.4
MJ/m².yr	1876

Market Composite EUI	
kWh/ft².yr	48.2
MJ/m².yr	1868

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7	°C	44.6	°F
Condenser Water	30	°C	86	°F
Supply Air	14.0	°C	57.2	°F

Peak Cooling Load	77	W/m²	24	Btu/hr.ft²	492	ft²/Ton
Seasonal Cooling Load (Tertiary Load)	99.2	MJ/m².yr	2.6	kWh/ft².yr		

Sizing Factor 0.65 Operation (occ. period) 3000 hrs/year Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C) 90.0%

Electric Fuel Share 100.0% Gas Fuel Share 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	0.8
MJ/m².yr	30

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	0.8
MJ/m².yr	30

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	10%				80%
Eff./COP	0.65				0.80

	Fossil		Elec. Res.
Fuel Share	90%		10%
Blended Efficiency	0.78		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 250.0

Wetting Use Percentage 90%

All Electric EUI	
kWh/ft².yr	7.1
MJ/m².yr	275

Fossil Fuel EUI	
kWh/ft².yr	8.2
MJ/m².yr	319

Market Composite EUI	
kWh/ft².yr	8.1
MJ/m².yr	314.7

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EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Hospital	0		Inland North
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	5.0	L/s.m²	0.99	CFM/ft²
System Static Pressure CAV	1500	Pa	6.0	wg
System Static Pressure VAV	1100	Pa	4.4	wg
Fan Efficiency	55%			
Fan Motor Efficiency	89%			
Sizing Factor	1.00			
Fan Design Load CAV	15.4	W/m²	1.43	W/ft²
Fan Design Load VAV	11.3	W/m²	1.05	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	50%	20%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	50%	50%	100%	0%
Comments:				

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m²	0.03	CFM/ft²
Other Exhaust (Smoking/Conference)	0.5	L/s.m²	0.10	CFM/ft²
Total Building Exhaust	0.6	L/s.m²	0.13	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.9	W/m²	0.08	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.013	kW/kW	0.05	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	1.00	W/m²	0.09	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.004	L/s.m²	0.006	U.S. gpm/ft²
Pump Head Pressure	100	kPa	33.333333	ft
Pump Efficiency	60%			
Pump Motor Efficiency	88%			
Sizing Factor	1.0			
Pump Connected Load	0.77	W/m²	0.07	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.003	L/s.m²	0.0049	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	60%					
Pump Motor Efficiency	88%					
Sizing Factor	0.8					
Pump Connected Load	0.5	W/m²	0.05	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	55.3	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	7.5	kWh/m².yr
Condenser Pump Energy Consumption	1.7	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.3	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	2.5	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI	kWh/ft².yr	6.3
	MJ/m².yr	242.3

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Hospital	**0**		**Inland North**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**18.6** kWh/ft².yr	**721.2** MJ/m².yr	**Fossil Fue**	**63.1** kWh/ft².yr	**2,445.6** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	4.8	187.2
ARCHITECTURAL LIGHTING	0.7	27.4
SPECIAL PURPOSE LIGHTING	0.0	0.0
OTHER PLUG LOADS	1.7	67.3
HVAC FANS & PUMPS	6.3	242.3
REFRIGERATION	0.4	15.0
COMPUTER EQUIPMENT	1.3	51.4
ELEVATORS	0.3	11.6
OUTDOOR LIGHTING	0.8	32.2

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.8	30.0	47.5	1,838.4
SPACE COOLING	0.7	27.3	0.0	0.0
DOMESTIC HOT WATER	0.7	27.5	7.4	287.2
FOOD SERVICE EQUIPMENT	0.1	2.0	1.8	70.0
MISCELLANEOUS	0.0	0.0	6.5	250.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Nursing Home	50,000 to 100,000 ft²		Inland North
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.61	W/m².°C	0.11	Btu/hr.ft² . °F	Typical Building Size	8,364	m²	90,000	ft²
Roof U value (W/m².°C)	0.34	W/m².°C	0.06	Btu/hr.ft² . °F	Typical Footprint (m²)	4,182	m²	45,000	ft²
Glazing U value (W/m².°C)	3.50	W/m².°C	0.62	Btu/hr.ft² . °F	Footprint Aspect Ratio (L:W)	7			
					Percent Conditioned Space	100%			
					Percent Conditioned Space Defined as Exterior Zone	45%			
Window/Wall Ratio (WIWAR) (%)	0.28								
Shading Coefficient (SC)	0.60				Typical # Stories	2			
					Floor to Floor Height (m)	3.7	m	12.0	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	90%		0%		10%	0%	0%		100%
Min. Air Flow (%)					60%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	30	m²/person	323	ft²/person	%OA	26.76%
Occupancy Schedule Occ. Period	100%					
Occupancy Schedule Unocc. Period	95%					
Fresh Air Requirements or Outside Air	40	L/s.person	85	CFM/person		

Fresh Air Control Type *(enter a 1, 2 or 3)	1	If Fresh Air Control Type = "2" enter % FA. to the right:	15%			
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)		If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation	0.5	L/s.m²	0.10	CFM/ft²
			50%	operation (%)		

Sizing Factor	2			
Total Air Circulation or Design Air Flow	4.98	L/s.m²	0.98	CFM/ft²
Infiltration Rate	0.30	L/s.m²	0.06	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	3,207,390	
Peak Zone Sensible Load	949,002	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	44,148	
Total air circulation or Design air	4.98	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	23	°C	73.4	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	22	°C	71.6	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	22	°C	71.6	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning — Changes/Year:

Incidence of Annual Room Controls Maintenance:

Incidence of Annual HVAC Controls Maintenance:

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Nursing Home	50,000 to 100,000 ft^2		Inland North
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	267	Lux	24.8	ft-candles
Floor Fraction (GLFF)	0.70			
Connected Load	6.9	W/m^2	0.6	W/ft^2
Occ. Period(Hrs./yr.)	3400			
Unocc. Period(Hrs./yr.)	5360			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	20%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	200	300	500	1000	Total
% Distribution	33%	67%	0%	0%	100%
Weighted Average					**267**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)					100.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI		
EUI	kWh/ft^2.yr	1.9
	MJ/m^2.yr	75

ARCHITECTURAL LIGHTING

Light Level	233	Lux	21.7	ft-candles
Floor Fraction (ALFF)	0.30			
Connected Load	18.6	W/m^2	1.7	W/ft^2
Occ. Period(Hrs./yr.)	3400			
Unocc. Period(Hrs./yr.)	5360			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	30%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	200	300	400	500	Total
% Distribution	67%	33%	0%	0%	100%
Weighted Average					**233**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	35%	65%						100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI		
EUI	kWh/ft^2.yr	2.5
	MJ/m^2.yr	97

SPECIAL PURPOSE LIGHTING

Light Level	0.00	Lux	0.0	ft-candles
Floor Fraction (HBLFF)	0.00			
Connected Load	0.0	W/m^2	0.0	W/ft^2
Occ. Period(Hrs./yr.)	4000			
Unocc. Period(Hrs./yr.)	4760			
Usage During Occupied Period	0%			
Usage During Unoccupied Period	100%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 | 1.00

Light Level (Lux)	300	500	700	1000	Total
% Distribution		0%	0%	0%	0%
Weighted Average					**0**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)								0.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI		
EUI	kWh/ft^2.yr	0.0
	MJ/m^2.yr	0

TOTAL LIGHTING

Overall LPD	10.41 W/m^2	EUI TOTAL	kWh/ft^2.yr	4.4
	0.97 W/ft^2		MJ/m^2.yr	172

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Servers	Plug Loads
Measured Power (W/device)	55	51	100	200	217	
Density (device/occupant)	0.477744	0.477744	0.02	0.02	0.04	
Connected Load	0.9 W/m^2	0.8 W/m^2	0.1 W/m^2	0.1 W/m^2	0.5 W/m^2	1.35 W/m^2
	0.1 W/ft^2	0.1 W/ft^2	0.01 W/ft^2	0.01 W/ft^2	0.05 W/ft^2	0.13 W/ft^2
Diversity Occupied Period	90%	90%	90%	90%	100%	90%
Diversity Unoccupied Period	50%	50%	50%	50%	100%	25%
Operation Occ. Period (hrs./year)	2000	2000	2600	2600	2600	4100
Operation Unocc. Period (hrs./year)	6760	6760	6160	6160	6160	4660

Total end-use load (occupied period)	3.4 W/m^2	0.3 W/ft^2
Total end-use load (unocc. period)	1.8 W/m^2	0.2 W/ft^2
Usage during occupied period	100%	
Usage during unoccupied period	52%	

Computer Equipment	EUI	kWh/ft^2.yr	1.33
		MJ/m^2.yr	51.37
Plug Loads	EUI	kWh/ft^2.yr	0.61
		MJ/m^2.yr	23.60

FOOD SERVICE EQUIPMENT

Provide description below:

	Gas EUI		Electric EUI	
EUI	kWh/ft^2.yr	1.5	kWh/ft^2.yr	1.3
	MJ/m^2.yr	60.0	MJ/m^2.yr	50.0

REFRIGERATION

Provide description below:

Walk-in coolers/freezers, reach-in coolers/freezers, refrigerated buffet cases

EUI		
EUI	kWh/ft^2.yr	0.8
	MJ/m^2.yr	30.0

MISCELLANEOUS

Provide description below:

	Gas EUI		Electric EUI	
EUI	kWh/ft^2.yr	1.8	kWh/ft^2.yr	0.0
	MJ/m^2.yr	70.0	MJ/m^2.yr	

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Nursing Home	**50,000 to 100,000 ft²**		**Inland North**
Baseline			

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	10%	40%	10%	15%	15%	0%	5%	0%	5%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff.) (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	41.5	W/m²	13.2	Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	617	MJ/m².yr	15.9	kWh/ft².yr
Sizing Factor	1.00			
Electric Fuel Share	10.0%	Fossil Fuel Share	90.0%	

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	12.7
MJ/m².yr	490

Gas EUI	
kWh/ft².yr	20.0
MJ/m².yr	776

Market Composite EUI	
kWh/ft².yr	19.3
MJ/m².yr	748

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	0.0%	0.0%	0.0%	15.0%	85.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7	°C	44.6	°F
Condenser Water	30	°C	86	°F
Supply Air	14.0	°C	57.2	°F

Peak Cooling Load	96	W/m²	30	Btu/hr.ft²	396	ft²/Ton
Seasonal Cooling Load (Tertiary Load)	89.5	MJ/m².yr	2.3	kWh/ft².yr		

Sizing Factor: 0.85 — Operation (occ. period): 3000 hrs/year — Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C): 30.0%

Electric Fuel Share: 100.0% — Gas Fuel Share: 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenan

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	1.1
MJ/m².yr	41

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	1.1
MJ/m².yr	41

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	25%				45%
Eff./COP	0.65				0.75

	Fossil		Elec. Res.
Fuel Share	70%		30%
Blended Efficiency	0.71		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load): 170.0

Wetting Use Percentage: 90%

All Electric EUI	
kWh/ft².yr	4.8
MJ/m².yr	187

Fossil Fuel EUI	
kWh/ft².yr	6.1
MJ/m².yr	238

Market Composite EUI	
kWh/ft².yr	5.7
MJ/m².yr	222.6

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Nursing Home	50,000 to 100,000 ft²		Inland North
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	5.0	L/s.m²	0.98	CFM/ft²
System Static Pressure CAV	500	Pa	2.0	wg
System Static Pressure VAV	500	Pa	2.0	wg
Fan Efficiency	52%			
Fan Motor Efficiency	75%			
Sizing Factor	1.00			
Fan Design Load CAV	6.4	W/m²	0.59	W/ft²
Fan Design Load VAV	6.4	W/m²	0.59	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	90%	10%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	80%	20%	100%	0%

Comments:

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.0	L/s.m²	0.01	CFM/ft²
Other Exhaust (Smoking/Conference)	0.5	L/s.m²	0.10	CFM/ft²
Total Building Exhaust	0.5	L/s.m²	0.11	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.7	W/m²	0.07	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.020	kW/kW	0.07	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	1.91	W/m²	0.18	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.005	L/s.m²	0.007	U.S. gpm/ft²
Pump Head Pressure	0	kPa	0	ft
Pump Efficiency	55%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.00	W/m²	0.00	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.004	L/s.m²	0.0061	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	55%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.7	W/m²	0.07	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	47.6	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	6.4	kWh/m².yr
Condenser Pump Energy Consumption	0.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.5	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	3.7	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI		
	kWh/ft².yr	5.4
	MJ/m².yr	209.6

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Nursing Home	**50,000 to 100,000 ft²**		**Inland North**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES: **Electricity:** **17.7** kWh/ft².yr **685.8** MJ/m².yr **Fossil Fuel** **25.7** kWh/ft².yr **995.3** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr	**END USE:**	Electricity kWh/ft².yr	Electricity MJ/m².yr	Fossil Fuel kWh/ft².yr	Fossil Fuel MJ/m².yr
GENERAL LIGHTING	1.9	74.8					
ARCHITECTURAL LIGHTING	2.5	97.2	SPACE HEATING	1.3	49.0	18.0	698.7
SPECIAL PURPOSE LIGHTING	0.0	0.0	SPACE COOLING	0.3	12.2	0.0	0.0
OTHER PLUG LOADS	0.6	23.6	DOMESTIC HOT WATER	1.4	56.0	4.3	166.6
HVAC FANS & PUMPS	5.4	209.6	FOOD SERVICE EQUIPMENT	1.3	50.0	1.5	60.0
REFRIGERATION	0.8	30.0	MISCELLANEOUS	0.0	0.0	1.8	70.0
COMPUTER EQUIPMENT	1.3	51.4					
ELEVATORS	0.3	11.6					
OUTDOOR LIGHTING	0.5	20.4					

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Schools	> 50,000 ft2		Inland North
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.50	W/m².°C	0.09	Btu/hr.ft² . °F
Roof U value (W/m².°C)	0.34	W/m².°C	0.06	Btu/hr.ft² . °F
Glazing U value (W/m².°C)	3.50	W/m².°C	0.62	Btu/hr.ft² . °F
Window/Wall Ratio (WIWAR) (%)	0.15			
Shading Coefficient (SC)	0.45			

Typical Building Size	9,300	m²	100,068	ft²
Typical Footprint (m²)	4,650	m²	50,034	ft²
Footprint Aspect Ratio (L:W)	5			
Percent Conditioned Space	100%			
Percent Conditioned Space Defined as Exterior Zone	37%			
Typical # Stories	2			
Floor to Floor Height (m)	4.0	m	13.2	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	80%		0%		20%		0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	10	m²/person	108	ft²/person
Occupancy Schedule Occ. Period	90%			
Occupancy Schedule Unocc. Period	0%			
Fresh Air Requirements or Outside Air	10	L/s.person	21	CFM/person

%OA 24.82%

Fresh Air Control Type *(enter a 1, 2 or 3) 1

(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right: 34%

If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation 0.5 L/s.m² 0.10 CFM/ft²; 50% operation (%)

Sizing Factor	2			
Total Air Circulation or Design Air Flow	4.03	L/s.m²	0.79	CFM/ft²
Infiltration Rate	0.26	L/s.m²	0.05	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	2,890,837	
Peak Zone Sensible Load	853,420	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	39,701	
Total air circulation or Design air	4.03	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	23	°C	73.4	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	19.5	°C	67.1	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Large Schools	**> 50,000 ft2**		**Inland North**
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	450	Lux	41.8	ft-candles
Floor Fraction (GLFF)	0.89			
Connected Load	11.6	W/m²	1.1	W/ft²
Occ. Period(Hrs./yr.)	2500			
Unocc. Period(Hrs./yr.)	6260			
Usage During Occupied Period	85%			
Usage During Unoccupied Period	10%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	300	500	700	1000	Total
% Distribution	25%	75%	0%	0%	100%
Weighted Average					**450**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)					100.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	2.6
	MJ/m².yr	102

ARCHITECTURAL LIGHTING

Light Level	300	Lux	27.9	ft-candles
Floor Fraction (ALFF)	0.01			
Connected Load	19.3	W/m²	1.8	W/ft²
Occ. Period(Hrs./yr.)	3000			
Unocc. Period(Hrs./yr.)	5760			
Usage During Occupied Period	90%			
Usage During Unoccupied Period	75%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	300	500	700	1000	Total
% Distribution	100%	0%	0%	0%	100%
Weighted Average					**300**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	20%	80%						100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI	kWh/ft².yr	0.1
	MJ/m².yr	5

EUI = Load X Hrs. X SF X GLFF

SPECIAL PURPOSE LIGHTING

Light Level	300.00	Lux	27.9	ft-candles
Floor Fraction (HBLFF)	0.10			
Connected Load	14.0	W/m²	1.3	W/ft²
Occ. Period(Hrs./yr.)	3000			
Unocc. Period(Hrs./yr.)	5760			
Usage During Occupied Period	100%			
Usage During Unoccupied Period	0%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 | 1.00

Light Level (Lux)	300	500	700	1000	Total
% Distribution	100%	0%	0%	0%	100%
Weighted Average					**300**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)						100%		100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	0.4
	MJ/m².yr	15

TOTAL LIGHTING	Overall LPD	11.94 W/m²	EUI TOTAL	kWh/ft².yr	3.2
		1.11 W/ft²		MJ/m².yr	122

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Servers		Plug Loads	
Measured Power (W/device)	55		51		100		200		217			
Density (device/occupant)	0.222732		0.222732		0.02		0.02		0.01			
Connected Load	1.2	W/m²	1.1	W/m²	0.2	W/m²	0.4	W/m²	0.5	W/m²	0.1	W/m²
	0.1	W/ft²	0.1	W/ft²	0.02	W/ft²	0.04	W/ft²	0.05	W/ft²	0.01	W/ft²
Diversity Occupied Period	90%		90%		90%		90%		100%		100%	
Diversity Unoccupied Period	25%		25%		25%		25%		100%		0%	
Operation Occ. Period (hrs./year)	2000		2000		2000		2000		2600		3000	
Operation Unocc. Period (hrs./year)	6760		6760		6760		6760		6160		5760	

Total end-use load (occupied period)	3.3	W/m²	0.3	W/ft²
Total end-use load (unocc. period)	1.3	W/m²	0.1	W/ft²
Usage during occupied period	100%			
Usage during unoccupied period	38%			

Computer Equipment	EUI	kWh/ft².yr	1.37
		MJ/m².yr	53.21
Plug Loads	EUI	kWh/ft².yr	0.03
		MJ/m².yr	1.08

FOOD SERVICE EQUIPMENT

Provide description below:

Cafeteria

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	0.5	EUI	kWh/ft².yr	0.1
	MJ/m².yr	20.0		MJ/m².yr	2.1

REFRIGERATION

Provide description below:

Unknown

EUI	kWh/ft².yr	0.1
	MJ/m².yr	2.1

MISCELLANEOUS

Provide description below:

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	0.1	EUI	kWh/ft².yr	0.0
	MJ/m².yr	5.0		MJ/m².yr	1.0

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Schools	> 50,000 ft2		Inland North
Baseline			

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	10%	60%	10%	5%	0%	0%	3%	10%	2%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff. (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	34.6	W/m²	11.0	Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	476	MJ/m².yr	12.3	kWh/ft².yr
Sizing Factor	1.00			
Electric Fuel Share	15.0%	Fossil Fuel Share	85.0%	

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI		
	kWh/ft².yr	5.8
	MJ/m².yr	225

Gas EUI		
	kWh/ft².yr	15.4
	MJ/m².yr	595

Market Composite EUI		
	kWh/ft².yr	13.9
	MJ/m².yr	539

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7	°C	44.6	°F
Condenser Water	30	°C	86	°F
Supply Air	14.0	°C	57.2	°F

Peak Cooling Load	91	W/m²	29	Btu/hr.ft²	415	ft²/Ton
Seasonal Cooling Load (Tertiary Load)	59.0	MJ/m².yr	1.5	kWh/ft².yr		

Sizing Factor 1.00 — Operation (occ. period) 3000 hrs/year — Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C) 20.0%

Electric Fuel Share 100.0% — Gas Fuel Share 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenan

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI		
	kWh/ft².yr	0.7
	MJ/m².yr	25

Natural Gas EUI		
	kWh/ft².yr	0.0
	MJ/m².yr	0

Market Composite EUI		
	kWh/ft².yr	0.7
	MJ/m².yr	25

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	65%				25%
Eff./COP	0.65				0.75

	Fossil		Elec. Res.
Fuel Share	90%		10%
Blended Efficiency	0.68		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 35.0

Wetting Use Percentage 90%

All Electric EUI		
	kWh/ft².yr	1.0
	MJ/m².yr	38

Fossil Fuel EUI		
	kWh/ft².yr	1.3
	MJ/m².yr	52

Market Composite EUI		
	kWh/ft².yr	1.3
	MJ/m².yr	50.3

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: Large Schools — Baseline | **SIZE:** > 50,000 ft2 | **VINTAGE:** | **REGION:** Inland North

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	4.0	L/s.m²	0.79	CFM/ft²
System Static Pressure CAV	500	Pa	2.0	wg
System Static Pressure VAV	500	Pa	2.0	wg
Fan Efficiency	60%			
Fan Motor Efficiency	88%			
Sizing Factor	1.00			
Fan Design Load CAV	3.8	W/m²	0.35	W/ft²
Fan Design Load VAV	3.8	W/m²	0.35	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	80%	20%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	50%	50%	50%	50%

Comments:

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.0	L/s.m²	0.01	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.1	L/s.m²	0.03	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.2	W/m²	0.02	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.027	kW/kW	0.09	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	2.46	W/m²	0.23	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.005	L/s.m²	0.007	U.S. gpm/ft²
Pump Head Pressure	45	kPa	15	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.54	W/m²	0.05	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.004	L/s.m²	0.0058	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.8	W/m²	0.07	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	21.5	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	1.2	kWh/m².yr
Condenser Pump Energy Consumption	1.2	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.4	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	3.9	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI		
	kWh/ft².yr	2.6
	MJ/m².yr	101.4

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Large Schools	**> 50,000 ft2**		**Inland North**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**9.0**	kWh/ft².yr	**347.8**	MJ/m².yr	**Fossil Fue**	**14.9** kWh/ft².yr	**577.1** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	2.6	102.5
ARCHITECTURAL LIGHTING	0.1	4.9
SPECIAL PURPOSE LIGHTING	0.4	15.1
OTHER PLUG LOADS	0.0	1.1
HVAC FANS & PUMPS	2.6	101.4
REFRIGERATION	0.1	2.1
COMPUTER EQUIPMENT	1.4	53.2
ELEVATORS	0.3	11.6
OUTDOOR LIGHTING	0.3	10.2

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.9	33.8	13.1	505.6
SPACE COOLING	0.1	5.1	0.0	0.0
DOMESTIC HOT WATER	0.1	3.8	1.2	46.5
FOOD SERVICE EQUIPMENT	0.1	2.1	0.5	20.0
MISCELLANEOUS	0.0	1.0	0.1	5.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Medium Schools	**< 50,000 ft2**		**Inland North**
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.57	W/m².°C	0.10	Btu/hr.ft² . °F	Typical Building Size	2,300	m²	24,748	ft²
Roof U value (W/m².°C)	0.34	W/m².°C	0.06	Btu/hr.ft² . °F	Typical Footprint (m²)	2,300	m²	24,748	ft²
Glazing U value (W/m².°C)	3.50	W/m².°C	0.62	Btu/hr.ft² . °F	Footprint Aspect Ratio (L:W)	5			
					Percent Conditioned Space	100%			
					Percent Conditioned Space Defined as Exterior Zone	50%			
Window/Wall Ratio (WIWAR) (%)	0.15								
Shading Coefficient (SC)	0.45				Typical # Stories	1			
					Floor to Floor Height (m)	4.0	m	13.2	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	90%		0%		10%		0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	10	m²/person	108	ft²/person	%OA	26.57%
Occupancy Schedule Occ. Period	90%					
Occupancy Schedule Unocc. Period	0%					
Fresh Air Requirements or Outside Air	8	L/s.person	16	CFM/person		

Fresh Air Control Type *(enter a 1, 2 or 3)	1	If Fresh Air Control Type = "2" enter % FA. to the right:	34%			
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)		If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation	0.5	L/s.m²	0.10	CFM/ft²
			50%	operation (%)		

Sizing Factor	1.2				
Total Air Circulation or Design Air Flow	2.82	L/s.m²	0.56	CFM/ft²	
Infiltration Rate	0.26	L/s.m²	0.05	CFM/ft²	

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	637,550	
Peak Zone Sensible Load	246,446	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	11,465	
Total air circulation or Design air	2.82	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	21	°C	69.8	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	20.4	°C	68.72	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning — Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Schools	< 50,000 ft2		Inland North
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	400	Lux	37.2	ft-candles
Floor Fraction (GLFF)	0.89			
Connected Load	10.3	W/m²	1.0	W/ft²

Occ. Period(Hrs./yr.)	2400
Unocc. Period(Hrs./yr.)	6360
Usage During Occupied Period	85%
Usage During Unoccupied Period	25%

Light Level (Lux)	300	500	700	1000				Total
% Distribution	50%	50%	0%	0%				100%
Weighted Average								**400**
	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			0.0%		100.0%			100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

Fixture Cleaning:
Incidence of Practice
Interval — years

Relamping Strategy & Incidence of Practice	Group	Spot

EUI	kWh/ft².yr	3.1
	MJ/m².yr	120

ARCHITECTURAL LIGHTING

Light Level	400	Lux	37.2	ft-candles
Floor Fraction (ALFF)	0.01			
Connected Load	25.8	W/m²	2.4	W/ft²

Occ. Period(Hrs./yr.)	2400
Unocc. Period(Hrs./yr.)	6360
Usage During Occupied Period	95%
Usage During Unoccupied Period	30%

Light Level (Lux)	300	500	700	1000				Total
% Distribution	50%	50%	0%	0%				100%
Weighted Average								**400**
	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	20%	80%						100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

Fixture Cleaning:
Incidence of Practice
Interval — years

Relamping Strategy & Incidence of Practice	Group	Spot

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	0.1
	MJ/m².yr	4

SPECIAL PURPOSE LIGHTING

Light Level	300.00	Lux	27.9	ft-candles
Floor Fraction (HBLFF)	0.10			
Connected Load	14.0	W/m²	1.3	W/ft²

Floor fraction check: should = 1.00 — 1.00

Occ. Period(Hrs./yr.)	2500
Unocc. Period(Hrs./yr.)	6260
Usage During Occupied Period	100%
Usage During Unoccupied Period	0%

Light Level (Lux)	300	500	700	1000				Total
% Distribution	100%	0%	0%	0%				100%
Weighted Average								**300**
	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)						100%		100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

Fixture Cleaning:
Incidence of Practice
Interval — years

Relamping Strategy & Incidence of Practice	Group	Spot

EUI	kWh/ft².yr	0.3
	MJ/m².yr	13

TOTAL LIGHTING

Overall LPD	9.45 W/m²	EUI TOTAL	kWh/ft².yr	3.5
	0.88 W/ft²		MJ/m².yr	137

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Servers		Plug Loads	
Measured Power (W/device)	55		51		100		200		217			
Density (device/occupant)	0.05		0.05		0.02		0.02		0.01			
Connected Load	0.3	W/m²	0.3	W/m²	0.2	W/m²	0.4	W/m²	0.5	W/m²	0.2	W/m²
	0.0	W/ft²	0.0	W/ft²	0.02	W/ft²	0.04	W/ft²	0.05	W/ft²	0.02	W/ft²
Diversity Occupied Period	90%		90%		90%		90%		100%		100%	
Diversity Unoccupied Period	25%		25%		25%		25%		100%		0%	
Operation Occ. Period (hrs./year)	2900		2900		2600		2600		2600		3000	
Operation Unocc. Period (hrs./year)	5860		5860		6160		6160		6160		5760	

Total end-use load (occupied period)	1.7	W/m²	0.2	W/ft²
Total end-use load (unocc. period)	0.8	W/m²	0.1	W/ft²

Usage during occupied period	100%
Usage during unoccupied period	46%

Computer Equipment	EUI	kWh/ft².yr	0.83
		MJ/m².yr	32.30
Plug Loads	EUI	kWh/ft².yr	0.06
		MJ/m².yr	2.16

FOOD SERVICE EQUIPMENT

Provide description below:

Cafeteria

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	0.1	EUI	kWh/ft².yr	0.1
	MJ/m².yr	5.0		MJ/m².yr	2.5

REFRIGERATION

Provide description below:

Unknown

EUI	kWh/ft².yr	0.1
	MJ/m².yr	3.0

MISCELLANEOUS

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	0.1	EUI	kWh/ft².yr	0.1
	MJ/m².yr	5.0		MJ/m².yr	5.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: Medium Schools Baseline | **SIZE:** < 50,000 ft2 | **VINTAGE:** | **REGION:** Inland North

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	10%	60%	14%	5%	0%	0%	0%	10%	1%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff. (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	53.1	W/m²	16.9	Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	600	MJ/m².yr	15.5	kWh/ft².yr
Sizing Factor	1.00			
Electric Fuel Share	11.0%	Fossil Fuel Share	89.0%	

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	kWh/ft².yr	6.1
	MJ/m².yr	236
Gas EUI	kWh/ft².yr	19.2
	MJ/m².yr	746
Market Composite EUI	kWh/ft².yr	17.8
	MJ/m².yr	690

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7	°C	44.6	°F
Condenser Water	30	°C	86	°F
Supply Air	14.0	°C	57.2	°F

Peak Cooling Load	81	W/m²	26	Btu/hr.ft²	466	ft²/Ton
Seasonal Cooling Load (Tertiary Load)	62.3	MJ/m².yr	1.6	kWh/ft².yr		

Sizing Factor: 1.00 — Operation (occ. period): 3000 hrs/year — Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C): 10.0%

Electric Fuel Share: 100.0% — Gas Fuel Share: 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenan

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	kWh/ft².yr	0.7
	MJ/m².yr	27
Natural Gas EUI	kWh/ft².yr	0.0
	MJ/m².yr	0
Market Composite EUI	kWh/ft².yr	0.7
	MJ/m².yr	27

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	75%				10%
Eff./COP	0.65				0.75

	Fossil	Elec. Res.
Fuel Share	85%	15%
Blended Efficiency	0.66	0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load): 35.0

Wetting Use Percentage: 90%

	All Electric EUI	Fossil Fuel EUI	Market Composite EUI
kWh/ft².yr	1.0	1.4	1.3
MJ/m².yr	38	53	50.7

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EXISTING BUILDINGS: Medium Schools Baseline | **SIZE:** < 50,000 ft2 | **VINTAGE:** | **REGION:** Inland North

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	2.8	L/s.m²	0.56	CFM/ft²
System Static Pressure CAV	250	Pa	1.0	wg
System Static Pressure VAV	250	Pa	1.0	wg
Fan Efficiency	60%			
Fan Motor Efficiency	88%			
Sizing Factor	1.00			
Fan Design Load CAV	1.3	W/m²	0.12	W/ft²
Fan Design Load VAV	1.3	W/m²	0.12	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	90%	10%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	50%	50%	50%	50%

Comments:

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m²	0.02	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.2	L/s.m²	0.04	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.2	W/m²	0.02	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.027	kW/kW	0.09	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	2.19	W/m²	0.20	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.004	L/s.m²	0.006	U.S. gpm/ft²
Pump Head Pressure	45	kPa	15	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.48	W/m²	0.05	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.003	L/s.m²	0.0052	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.7	W/m²	0.07	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	7.9	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	1.5	kWh/m².yr
Condenser Pump Energy Consumption	0.9	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.4	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	3.5	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI		
	kWh/ft².yr	1.3
	MJ/m².yr	51.2

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Medium Schools	**< 50,000 ft2**		**Inland North**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**7.5**	kWh/ft².yr	**289.1**	MJ/m².yr	**Fossil Fuel**	**18.5** kWh/ft².yr **718.5** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	3.1	120.2
ARCHITECTURAL LIGHTING	0.1	3.9
SPECIAL PURPOSE LIGHTING	0.3	12.6
OTHER PLUG LOADS	0.1	2.2
HVAC FANS & PUMPS	1.3	51.2
REFRIGERATION	0.1	3.0
COMPUTER EQUIPMENT	0.8	32.3
ELEVATORS	0.3	11.6
OUTDOOR LIGHTING	0.3	10.2

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.7	26.0	17.1	663.6
SPACE COOLING	0.1	2.7	0.0	0.0
DOMESTIC HOT WATER	0.1	5.8	1.2	45.0
FOOD SERVICE EQUIPMENT	0.1	2.5	0.1	5.0
MISCELLANEOUS	0.1	5.0	0.1	5.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
University-Colleges	0		Inland North
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.54	W/m².°C	0.10	Btu/hr.ft² . °F
Roof U value (W/m².°C)	0.34	W/m².°C	0.06	Btu/hr.ft² . °F
Glazing U value (W/m².°C)	3.50	W/m².°C	0.62	Btu/hr.ft² . °F
Window/Wall Ratio (WIWAR) (%)	0.30			
Shading Coefficient (SC)	0.45			

Typical Building Size	9,000	m²	96,840	ft²
Typical Footprint (m²)	3,000	m²	32,280	ft²
Footprint Aspect Ratio (L:W)	7			
Percent Conditioned Space	100%			
Percent Conditioned Space Defined as Exterior Zone	50%			
Typical # Stories	3			
Floor to Floor Height (m)	3.7	m	12.0	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	50%		0%		50%		0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	14	m²/person	151	ft²/person
Occupancy Schedule Occ. Period	90%			
Occupancy Schedule Unocc. Period	0%			
Fresh Air Requirements or Outside Air	20	L/s.person	42	CFM/person

%OA 31.07%

Fresh Air Control Type *(enter a 1, 2 or 3) | 1 | If Fresh Air Control Type = "2" enter % FA. to the right: 34%
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air) | If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation: 0.5 L/s.m² | 0.10 CFM/ft² | 50% operation (%)

Sizing Factor	1.65			
Total Air Circulation or Design Air Flow	4.60	L/s.m²	0.91	CFM/ft²
Infiltration Rate	0.26	L/s.m²	0.05	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	3,811,300	
Peak Zone Sensible Load	1,142,130	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	53,132	
Total air circulation or Design air	4.60	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	24	°C	75.2	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	20.4	°C	68.72	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning — Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
University-Colleges	0		Inland North
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	480	Lux	44.6	ft-candles
Floor Fraction (GLFF)	0.93			
Connected Load	12.4	W/m²	1.2	W/ft²
Occ. Period(Hrs./yr.)	4100			
Unocc. Period(Hrs./yr.)	4660			
Usage During Occupied Period	90%			
Usage During Unoccupied Period	20%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	300	500	700	1000				Total
% Distribution	10%	90%	0%	0%				100%
Weighted Average								**480**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)					100.0%			100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	5.0
	MJ/m².yr	192

ARCHITECTURAL LIGHTING

Light Level	300	Lux	27.9	ft-candles
Floor Fraction (ALFF)	0.02			
Connected Load	20.9	W/m²	1.9	W/ft²
Occ. Period(Hrs./yr.)	4100			
Unocc. Period(Hrs./yr.)	4660			
Usage During Occupied Period	100%			
Usage During Unoccupied Period	100%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	300	500	700	1000				Total
% Distribution	100%	0%	0%	0%				100%
Weighted Average								**300**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	25%	75%						100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	0.3
	MJ/m².yr	13

SPECIAL PURPOSE LIGHTING

Light Level	500.00	Lux	46.5	ft-candles
Floor Fraction (HBLFF)	0.05			
Connected Load	18.9	W/m²	1.8	W/ft²
Occ. Period(Hrs./yr.)	4100			
Unocc. Period(Hrs./yr.)	4660			
Usage During Occupied Period	90%			
Usage During Unoccupied Period	20%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 | 1.00

Light Level (Lux)	300	500	700	1000				Total
% Distribution	0%	100%	0%	0%				100%
Weighted Average								**500**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)						100%		100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.7	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	0.4
	MJ/m².yr	16

TOTAL LIGHTING

Overall LPD	11.95 W/m²	EUI TOTAL	kWh/ft².yr	5.7
	1.11 W/ft²		MJ/m².yr	221

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Servers		Plug Loads	
Measured Power (W/device)	55		51		100		200		217			
Density (device/occupant)	0.311825		0.311825		0.02		0.02		0.01			
Connected Load	1.2	W/m²	1.1	W/m²	0.1	W/m²	0.3	W/m²	0.5	W/m²	1.3	W/m²
	0.1	W/ft²	0.1	W/ft²	0.01	W/ft²	0.03	W/ft²	0.05	W/ft²	0.12	W/ft²
Diversity Occupied Period	90%		90%		90%		90%		100%		100%	
Diversity Unoccupied Period	50%		50%		50%		50%		100%		20%	
Operation Occ. Period (hrs./year)	2000		2000		2600		2600		2600		2000	
Operation Unocc. Period (hrs./year)	6760		6760		6160		6160		6160		6760	

Total end-use load (occupied period)	4.3	W/m²	0.4	W/ft²
Total end-use load (unocc. period)	2.2	W/m²	0.2	W/ft²
Usage during occupied period	100%			
Usage during unoccupied period	50%			

Computer Equipment	EUI	kWh/ft².yr	1.76
		MJ/m².yr	68.30
Plug Loads	EUI	kWh/ft².yr	0.40
		MJ/m².yr	15.69

FOOD SERVICE EQUIPMENT

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	0.8	EUI	kWh/ft².yr	0.3
	MJ/m².yr	30.0		MJ/m².yr	10.0

REFRIGERATION

Provide description below:

Unknown

EUI	kWh/ft².yr	0.5
	MJ/m².yr	20.0

MISCELLANEOUS

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	1.0	EUI	kWh/ft².yr	0.0
	MJ/m².yr	40.0		MJ/m².yr	0.0

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
University-Colleges	**0**		**Inland North**
Baseline			

SPACE HEATING

Heating Plant Type

							Electric			Other	
				Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	10%	49%	25%	10%	0%	0%	2%	1%	2%	0%	99%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff.) (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	47.4	W/m²	15.0	Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	911	MJ/m².yr	23.5	kWh/ft².yr
Sizing Factor	1.00			
Electric Fuel Share	5.0%	Fossil Fuel Share	95.0%	

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	16.5
MJ/m².yr	640

Gas EUI	
kWh/ft².yr	29.0
MJ/m².yr	1122

Market Composite EUI	
kWh/ft².yr	28.0
MJ/m².yr	1086

SPACE COOLING

A/C Plant Type

			WSHP			Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	0.0%	25.0%	0.0%	0.0%	75.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7	°C	44.6	°F
Condenser Water	30	°C	86	°F
Supply Air	14.0	°C	57.2	°F

Peak Cooling Load	124	W/m²	39	Btu/hr.ft²	305	ft²/Ton
Seasonal Cooling Load (Tertiary Load)	99.5	MJ/m².yr	2.6	kWh/ft².yr		

Sizing Factor: 1.00 — Operation (occ. period): 3000 hrs/year — Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C): 20.0%

Electric Fuel Share: 100.0% — Gas Fuel Share: 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	1.1
MJ/m².yr	44

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	1.1
MJ/m².yr	44

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	10%				80%
Eff./COP	0.65				0.75

	Fossil	Elec. Res.
Fuel Share	90%	10%
Blended Efficiency	0.74	0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load): 60.0

Wetting Use Percentage: 90%

All Electric EUI	
kWh/ft².yr	1.7
MJ/m².yr	66

Fossil Fuel EUI	
kWh/ft².yr	2.1
MJ/m².yr	81

Market Composite EUI	
kWh/ft².yr	2.1
MJ/m².yr	79.7

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EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
University-Colleges	0		Inland North
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	4.6	L/s.m²	0.91	CFM/ft²
System Static Pressure CAV	950	Pa	3.8	wg
System Static Pressure VAV	950	Pa	3.8	wg
Fan Efficiency	60%			
Fan Motor Efficiency	80%			
Sizing Factor	1.00			
Fan Design Load CAV	9.1	W/m²	0.85	W/ft²
Fan Design Load VAV	9.1	W/m²	0.85	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	50%	50%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	50%	50%	100%	0%
Comments:				

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m²	0.01	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.2	L/s.m²	0.03	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.2	W/m²	0.02	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.027	kW/kW	0.09	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	3.35	W/m²	0.31	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.007	L/s.m²	0.010	U.S. gpm/ft²
Pump Head Pressure	0	kPa	0	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.00	W/m²	0.00	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.005	L/s.m²	0.0079	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	1.1	W/m²	0.10	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	44.4	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	1.9	kWh/m².yr
Condenser Pump Energy Consumption	0.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.7	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	5.3	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI	kWh/ft².yr	4.9
	MJ/m².yr	188.8

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
University-Colleges	0		Inland North
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	Electricity:	15.5 kWh/ft².yr	599.5 MJ/m².yr	Fossil Fue	31.2 kWh/ft².yr	1,208.6 MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	5.0	191.8
ARCHITECTURAL LIGHTING	0.3	13.2
SPECIAL PURPOSE LIGHTING	0.4	15.7
OTHER PLUG LOADS	0.4	15.7
HVAC FANS & PUMPS	4.9	188.8
REFRIGERATION	0.5	20.0
COMPUTER EQUIPMENT	1.8	68.3
ELEVATORS	0.3	11.6
OUTDOOR LIGHTING	0.4	17.0

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.8	32.0	27.5	1,065.5
SPACE COOLING	0.2	8.9	0.0	0.0
DOMESTIC HOT WATER	0.2	6.6	1.9	73.1
FOOD SERVICE EQUIPMENT	0.3	10.0	0.8	30.0
MISCELLANEOUS	0.0	0.0	1.0	40.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Restaurant			**Inland North**
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.62	W/m².°C	0.11	Btu/hr.ft² . °F	Typical Building Size	781	m²	8,400	ft²
Roof U value (W/m².°C)	0.32	W/m².°C	0.06	Btu/hr.ft² . °F	Typical Footprint (m²)	781	m²	8,400	ft²
Glazing U value (W/m².°C)	3.50	W/m².°C	0.62	Btu/hr.ft² . °F	Footprint Aspect Ratio (L:W)	1			
					Percent Conditioned Space	100%			
					Percent Conditioned Space Defined as Exterior Zone	45%			
Window/Wall Ratio (WIWAR) (%)	0.18								
Shading Coefficient (SC)	0.69				Typical # Stories	1			
					Floor to Floor Height (m)	3.8	m	12.5	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	100%		0%		0%		0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	20	m²/person	215	ft²/person	%OA	28.36%
Occupancy Schedule Occ. Period	90%					
Occupancy Schedule Unocc. Period	0%					
Fresh Air Requirements or Outside Air	30	L/s.person	64	CFM/person		

Fresh Air Control Type *(enter a 1, 2 or 3)	1	If Fresh Air Control Type = "2" enter % FA. to the right:	0%			
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)		If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation	0.5	L/s.m²	0.10	CFM/ft²
			50%	operation (%)		

Sizing Factor	1.5			
Total Air Circulation or Design Air Flow	5.29	L/s.m²	1.04	CFM/ft²
Infiltration Rate	0.70	L/s.m²	0.14	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	363,998	
Peak Zone Sensible Load	125,374	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R.	13.2	ft³/lbm
Design CFM	5,832	
Total air circulation or Design air	5.29	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	22	°C	71.6	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	21	°C	69.8	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning — Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Restaurant			Inland North
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	400	Lux	37.1	ft-candles
Floor Fraction (GLFF)	0.30			
Connected Load	10.3	W/m²	1.0	W/ft²
Occ. Period(Hrs./yr.)	4100			
Unocc. Period(Hrs./yr.)	4660			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	30%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	300	400	500	1000				Total
% Distribution	33%	33%	33%	0%				100%
Weighted Average								**399.6**
	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)					100.0%			100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	1.5
	MJ/m².yr	59

ARCHITECTURAL LIGHTING

Light Level	280	Lux	26.0	ft-candles
Floor Fraction (ALFF)	0.70			
Connected Load	29.5	W/m²	2.7	W/ft²
Occ. Period(Hrs./yr.)	4100			
Unocc. Period(Hrs./yr.)	4660			
Usage During Occupied Period	80%			
Usage During Unoccupied Period	30%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	100	200	300	400				Total
% Distribution	10%	30%	30%	30%				100%
Weighted Average								**280**
	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	60%	40%						100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	9.0
	MJ/m².yr	348

SPECIAL PURPOSE LIGHTING

Light Level	0.00	Lux	0.0	ft-candles
Floor Fraction (HBLFF)	0.00			
Connected Load	0.0	W/m²	0.0	W/ft²
Occ. Period(Hrs./yr.)	4000			
Unocc. Period(Hrs./yr.)	4760			
Usage During Occupied Period	0%			
Usage During Unoccupied Period	100%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 | 1.00

Light Level (Lux)	300	500	700	1000				Total
% Distribution		0%	0%	0%				0%
Weighted Average								**0**
	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)								0.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	0.0
	MJ/m².yr	0

TOTAL LIGHTING	Overall LPD	23.77 W/m²	EUI TOTAL	kWh/ft².yr	10.5
		2.21 W/ft²		MJ/m².yr	407

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Servers		Plug Loads	
Measured Power (W/device)	55		51		100		200		217			
Density (device/occupant)	0.1614		0.1614		0.01		0.01		0.01			
Connected Load	0.4	W/m²	0.4	W/m²	0.1	W/m²	0.1	W/m²	0.5	W/m²	3.2	W/m²
	0.0	W/ft²	0.0	W/ft²	0.00	W/ft²	0.01	W/ft²	0.05	W/ft²	0.30	W/ft²
Diversity Occupied Period	90%		90%		90%		90%		100%		90%	
Diversity Unoccupied Period	50%		50%		50%		50%		100%		90%	
Operation Occ. Period (hrs./year)	2000		2000		2600		2600		2600		4100	
Operation Unocc. Period (hrs./year)	6760		6760		6160		6160		6160		4660	

Total end-use load (occupied period)	4.3	W/m²	0.4	W/ft²
Total end-use load (unocc. period)	3.9	W/m²	0.4	W/ft²
Usage during occupied period	100%			
Usage during unoccupied period	91%			

Computer Equipment	EUI	kWh/ft².yr	0.90
		MJ/m².yr	34.97
Plug Loads	EUI	kWh/ft².yr	2.34
		MJ/m².yr	90.82

FOOD SERVICE EQUIPMENT

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	23.2	EUI	kWh/ft².yr	8.6
	MJ/m².yr	900.0		MJ/m².yr	333.0

REFRIGERATION

Provide description below:

EUI	kWh/ft².yr	16.8
	MJ/m².yr	650.0

MISCELLANEOUS

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	0.8	EUI	kWh/ft².yr	2.3
	MJ/m².yr	30.0		MJ/m².yr	90.0

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **SIZE:** **VINTAGE:** **REGION:**
Restaurant **Inland North**
Baseline

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	1%	2%	1%	59%	30%	0%	2%	0%	5%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff. (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	61.1	W/m²	19.4	Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	1022	MJ/m².yr	26.4	kWh/ft².yr
Sizing Factor	1.00			
Electric Fuel Share	7.0%	Fossil Fuel Share	93.0%	

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	23.3
MJ/m².yr	902

Gas EUI	
kWh/ft².yr	34.4
MJ/m².yr	1331

Market Composite EUI	
kWh/ft².yr	33.6
MJ/m².yr	1301

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	0.0%	0.0%	0.0%	10.0%	90.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7	°C	44.6	°F
Condenser Water	30	°C	86	°F
Supply Air	14.0	°C	57.2	°F

Peak Cooling Load	164	W/m²	52	Btu/hr.ft²	231	ft²/Ton
Seasonal Cooling Load (Tertiary Load)	121.0	MJ/m².yr	3.1	kWh/ft².yr		

Sizing Factor 1.20 Operation (occ. period) 3000 hrs/year Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C) 70.0%

Electric Fuel Share 100.0% Gas Fuel Share 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenan

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	1.4
MJ/m².yr	56

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	1.4
MJ/m².yr	56

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Avg. Tank				Boiler
System Present (%)	65%				10%
Eff./COP	0.65				0.75

	Fossil		Elec. Res.
Fuel Share	75%		25%
Blended Efficiency	0.66		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 600.0

Wetting Use Percentage 10%

All Electric EUI	
kWh/ft².yr	17.0
MJ/m².yr	659

Fossil Fuel EUI	
kWh/ft².yr	23.4
MJ/m².yr	905

Market Composite EUI	
kWh/ft².yr	21.8
MJ/m².yr	843.2

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: Restaurant Baseline | **SIZE:** | **VINTAGE:** | **REGION:** Inland North

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	5.3	L/s.m²	1.04	CFM/ft²
System Static Pressure CAV	500	Pa	2.0	wg
System Static Pressure VAV	500	Pa	2.0	wg
Fan Efficiency	60%			
Fan Motor Efficiency	80%			
Sizing Factor	1.00			
Fan Design Load CAV	5.5	W/m²	0.51	W/ft²
Fan Design Load VAV	5.5	W/m²	0.51	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	100%	0%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	80%	20%	100%	0%
Comments:				

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.3	L/s.m²	0.05	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.4	L/s.m²	0.07	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.5	W/m²	0.04	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.020	kW/kW	0.07	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	3.28	W/m²	0.30	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.009	L/s.m²	0.013	U.S. gpm/ft²
Pump Head Pressure	0	kPa	0	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.00	W/m²	0.00	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.007	L/s.m²	0.0104	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	0	kPa	0	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.0	W/m²	0.00	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	42.5	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	4.2	kWh/m².yr
Condenser Pump Energy Consumption	0.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.7	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	0.0	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI		
	kWh/ft².yr	4.4
	MJ/m².yr	170.2

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Restaurant			**Inland North**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES: **Electricity:** **56.8** kWh/ft².yr **2,200.8** MJ/m².yr **Fossil Fue** **73.5** kWh/ft².yr **2,846.7** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr	**END USE:**	Electricity kWh/ft².yr	Electricity MJ/m².yr	Fossil Fuel kWh/ft².yr	Fossil Fuel MJ/m².yr
GENERAL LIGHTING	1.5	59.0					
ARCHITECTURAL LIGHTING	9.0	348.2	SPACE HEATING	1.6	63.2	32.0	1,238.3
SPECIAL PURPOSE LIGHTING	0.0	0.0	SPACE COOLING	1.0	39.0	0.0	0.0
OTHER PLUG LOADS	2.3	90.8	DOMESTIC HOT WATER	4.3	164.8	17.5	678.4
HVAC FANS & PUMPS	4.4	170.2	FOOD SERVICE EQUIPMENT	8.6	333.0	23.2	900.0
REFRIGERATION	16.8	650.0	MISCELLANEOUS	2.3	90.0	0.8	30.0
COMPUTER EQUIPMENT	0.9	35.0					
ELEVATORS	0.3	11.6					
OUTDOOR LIGHTING	3.8	145.9					

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Warehouse/Whsale	0		Inland North
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.45	W/m².°C	0.08	Btu/hr.ft² . °F
Roof U value (W/m².°C)	0.32	W/m².°C	0.06	Btu/hr.ft² . °F
Glazing U value (W/m².°C)	3.50	W/m².°C	0.62	Btu/hr.ft² . °F
Window/Wall Ratio (WIWAR) (%)	0.05			
Shading Coefficient (SC)	0.80			

Typical Building Size	3,200	m²	34,432	ft²
Typical Footprint (m²)	3,200	m²	34,432	ft²
Footprint Aspect Ratio (L:W)	1			
Percent Conditioned Space	100%			
Percent Conditioned Space Defined as Exterior Zone	40%			
Typical # Stories	1			
Floor to Floor Height (m)	6.1	m	19.9	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	100%		0%		0%		0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	100	m²/person	1076	ft²/person
Occupancy Schedule Occ. Period	90%			
Occupancy Schedule Unocc. Period	0%			
Fresh Air Requirements or Outside Air	30	L/s.person	64	CFM/person

%OA 21.47%

Fresh Air Control Type *(enter a 1, 2 or 3) | 1

(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right:	0%			
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation	0.5	L/s.m²	0.10	CFM/ft²
	50%	operation (%)		

Sizing Factor	1			
Total Air Circulation or Design Air Flow	1.40	L/s.m²	0.28	CFM/ft²
Infiltration Rate	0.38	L/s.m²	0.07	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	399,246	
Peak Zone Sensible Load	203,620	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	9,472	
Total air circulation or Design air	1.40	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	22	°C	71.6	°F	13	°C	55.4	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	16	°C	60.8	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	20.25	°C	68.45	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning — Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Warehouse/Whsale	0		Inland North
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	400	Lux	37.2	ft-candles
Floor Fraction (GLFF)	0.18			
Connected Load	10.3	W/m²	1.0	W/ft²
Occ. Period(Hrs./yr.)	3500			
Unocc. Period(Hrs./yr.)	5260			
Usage During Occupied Period	100%			
Usage During Unoccupied Period	25%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	300	500	700	1000				Total
% Distribution	50%	50%	0%	0%				100%
Weighted Average								**400**
	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			0.0%	0%	100.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI kWh/ft².yr 0.8
MJ/m².yr 32

ARCHITECTURAL LIGHTING

Light Level	300	Lux	27.9	ft-candles
Floor Fraction (ALFF)	0.01			
Connected Load	23.3	W/m²	2.2	W/ft²
Occ. Period(Hrs./yr.)	2500			
Unocc. Period(Hrs./yr.)	6260			
Usage During Occupied Period	100%			
Usage During Unoccupied Period	50%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	300	500	700	1000				Total
% Distribution	100%	0%	0%	0%				100%
Weighted Average								**300**
	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	33%	67%					0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI kWh/ft².yr 0.1
EUI = Load X Hrs. X SF X GLFF MJ/m².yr 5

SPECIAL PURPOSE LIGHTING

Light Level	400.00	Lux	37.2	ft-candles
Floor Fraction (HBLFF)	0.81			
Connected Load	15.6	W/m²	1.5	W/ft²
Occ. Period(Hrs./yr.)	3500			
Unocc. Period(Hrs./yr.)	5260			
Usage During Occupied Period	100%			
Usage During Unoccupied Period	25%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 1.00

Light Level (Lux)	300	500	700	1000				Total
% Distribution	50%	50%	0%	0%				100%
Weighted Average								**400**
	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)						85%	15%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.7	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI kWh/ft².yr 5.7
MJ/m².yr 219

TOTAL LIGHTING Overall LPD 14.73 W/m² 1.37 W/ft² EUI TOTAL kWh/ft².yr 6.6 MJ/m².yr 256

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Servers		Plug Loads	
Measured Power (W/device)	55		51		100		200		217			
Density (device/occupant)	0.5918		0.5918		0.03		0.03		0.06			
Connected Load	0.3	W/m²	0.3	W/m²	0.0	W/m²	0.1	W/m²	0.5	W/m²	2.5	W/m²
	0.0	W/ft²	0.0	W/ft²	0.00	W/ft²	0.01	W/ft²	0.05	W/ft²	0.23	W/ft²
Diversity Occupied Period	90%		90%		90%		90%		100%		90%	
Diversity Unoccupied Period	50%		50%		50%		50%		100%		25%	
Operation Occ. Period (hrs./year)	2000		2000		2600		2600		2600		4100	
Operation Unocc. Period (hrs./year)	6760		6760		6160		6160		6160		4660	

Total end-use load (occupied period)	3.4	W/m²	0.3	W/ft²
Total end-use load (unocc. period)	1.5	W/m²	0.1	W/ft²
Usage during occupied period	100%			
Usage during unoccupied period	44%			

Computer Equipment	EUI	kWh/ft².yr	0.76
		MJ/m².yr	29.58
Plug Loads	EUI	kWh/ft².yr	1.13
		MJ/m².yr	43.70

FOOD SERVICE EQUIPMENT

Provide description below:

	Gas EUI			Electric EUI		
	EUI	kWh/ft².yr	0.1	EUI	kWh/ft².yr	0.1
		MJ/m².yr	5.0		MJ/m².yr	5.0

REFRIGERATION

Provide description below:

Large refrigeration storage

EUI kWh/ft².yr 1.3
MJ/m².yr 50.0

MISCELLANEOUS

Provide description below:

	Gas EUI			Electric EUI		
	EUI	kWh/ft².yr	0.3	EUI	kWh/ft².yr	0.5
		MJ/m².yr	10.0		MJ/m².yr	20.0

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EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Warehouse/Whsale	0		Inland North
Baseline			

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						Gas	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Radiant	
System Present (%)	2%	5%	1%	35%	7%	30%		2%	3%	15%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	75%	1.70	3.00	100%	75%	
Performance (1 / Eff. (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.33	0.59	0.33	1.00	1.33	

Peak Heating Load	52.9	W/m²	16.8	Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	405	MJ/m².yr	10.5	kWh/ft².yr
Sizing Factor	1.00			
Electric Fuel Share	5.0%	Fossil Fuel Share	95.0%	

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	7.7
MJ/m².yr	297

Gas EUI	
kWh/ft².yr	13.8
MJ/m².yr	534

Market Composite EUI	
kWh/ft².yr	13.5
MJ/m².yr	523

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	0.0%	0.0%	0.0%	10.0%	90.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7	°C	44.6	°F
Condenser Water	30	°C	86	°F
Supply Air	13.0	°C	55.4	°F

Peak Cooling Load	37	W/m²	12	Btu/hr.ft²	1035	ft²/Ton
Seasonal Cooling Load (Tertiary Load)	38.4	MJ/m².yr	1.0	kWh/ft².yr		

Sizing Factor: 1.00 — Operation (occ. period): 3000 hrs/year — Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C): 30.0%

Electric Fuel Share: 100.0% — Gas Fuel Share: 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	0.2
MJ/m².yr	10

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	0.2
MJ/m².yr	10

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	65%				5%
Eff./COP	0.65				0.75

	Fossil		Elec. Res.
Fuel Share	70%		30%
Blended Efficiency	0.66		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load): 22.5

Wetting Use Percentage: 90%

All Electric EUI	
kWh/ft².yr	0.6
MJ/m².yr	25

Fossil Fuel EUI	
kWh/ft².yr	0.9
MJ/m².yr	34

Market Composite EUI	
kWh/ft².yr	0.8
MJ/m².yr	31.4

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Warehouse/Whsale	0		Inland North
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	1.4	L/s.m²	0.28	CFM/ft²
System Static Pressure CAV	425	Pa	1.7	wg
System Static Pressure VAV	425	Pa	1.7	wg
Fan Efficiency	60%			
Fan Motor Efficiency	80%			
Sizing Factor	1.00			
Fan Design Load CAV	1.2	W/m²	0.11	W/ft²
Fan Design Load VAV	1.2	W/m²	0.11	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	100%	0%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	0%	100%	100%	0%
Comments:				

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m²	0.01	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.2	L/s.m²	0.03	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.2	W/m²	0.02	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.020	kW/kW	0.07	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	0.73	W/m²	0.07	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.002	L/s.m²	0.003	U.S. gpm/ft²
Pump Head Pressure	0	kPa	0	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.00	W/m²	0.00	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.002	L/s.m²	0.0023	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	50	kPa	17	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.2	W/m²	0.01	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	4.3	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	1.9	kWh/m².yr
Condenser Pump Energy Consumption	0.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.1	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	0.7	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI	kWh/ft².yr	0.7
	MJ/m².yr	25.3

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Warehouse/Whsale	**0**		**Inland North**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES: **Electricity:** **12.5** kWh/ft².yr **483.4** MJ/m².yr **Fossil Fue** **14.1** kWh/ft².yr **546.1** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	0.8	32.2
ARCHITECTURAL LIGHTING	0.1	4.7
SPECIAL PURPOSE LIGHTING	5.7	219.1
OTHER PLUG LOADS	1.1	43.7
HVAC FANS & PUMPS	0.7	25.3
REFRIGERATION	1.3	50.0
COMPUTER EQUIPMENT	0.8	29.6
ELEVATORS	0.3	11.6
OUTDOOR LIGHTING	0.4	17.0

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.4	14.9	13.1	507.1
SPACE COOLING	0.1	2.9	0.0	0.0
DOMESTIC HOT WATER	0.2	7.4	0.6	24.0
FOOD SERVICE EQUIPMENT	0.1	5.0	0.1	5.0
MISCELLANEOUS	0.5	20.0	0.3	10.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Large High Rise	**> 9,300 m² (100,000 ft²)**		**Inland North**
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.81	W/m².°C	0.14	Btu/hr.ft² . °F	Typical Building Size	21,365	m²	229,887	ft²
Roof U value (W/m².°C)	0.34	W/m².°C	0.06	Btu/hr.ft² . °F	Typical Footprint (m²)	1,125	m²	12,100	ft²
Glazing U value (W/m².°C)	3.50	W/m².°C	0.62	Btu/hr.ft² . °F	Footprint Aspect Ratio (L:W)	1			
					Percent Conditioned Space	100%			
					Percent Conditioned Space Defined as Exterior Zone	45%			
Window/Wall Ratio (WIWAR) (%)	0.25								
Shading Coefficient (SC)	0.65				Typical # Stories	19			
					Floor to Floor Height (m)	3.7	m	12.0	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	100%		0%		0%		0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	40	m²/person	430	ft²/person	%OA 100.00%
Occupancy Schedule Occ. Period	25%				
Occupancy Schedule Unocc. Period	80%				
Fresh Air Requirements or Outside Air	10	L/s.person	21	CFM/person	

Fresh Air Control Type *(enter a 1, 2 or 3) | 3 | If Fresh Air Control Type = "2" enter % FA. to the right: | 0%
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air) | If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation | 0.25 L/s.m² | 0.05 CFM/ft²
75% operation (%)

Sizing Factor	1			
Total Air Circulation or Design Air Flow	0.25	L/s.m²	0.05	CFM/ft²
Infiltration Rate	0.05	L/s.m²	0.01	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)		L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based	Total
Incidence of Use	0%		100%	100%
Switchover Point		KJ/kg.	18	°C
		Btu/lbm	64.4	°F

Summary of Design Parameters		
Peak Design Cooling Load	2,920,674	
Peak Zone Sensible Load	1,838,997	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	85,550	
Total air circulation or Design air	1.89	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	20	°C	68	°F	13	°C	55.4	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	20.4	°C	68.72	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning — Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Large High Rise	**> 9,300 m² (100,000 ft²)**		**Inland North**
Baseline			

LIGHTING

GENERAL (Linear Fluorescent) LIGHTING

Light Level	160 Lux	14.9	ft-candles
Floor Fraction (GLFF)	0.10		
Connected Load	4.1 W/m²	0.4	W/ft²
Occ. Period(Hrs./yr.)	3400		
Unocc. Period(Hrs./yr.)	5360		
Usage During Occupied Period	90%		
Usage During Unoccupied Period	90%		
Fixture Cleaning:			
Incidence of Practice			
Interval	years		
Relamping Strategy & Incidence of Practice	Group	Spot	

Light Level (Lux)	50	100	200	300				Total
% Distribution	0%	60%	20%	20%				100%
Weighted Average								**160**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			0.0%	0%	100.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	0.3
	MJ/m².yr	12

ARCHITECTURAL (Incandescent & replacements) LIGHTING

Light Level	130 Lux	12.1	ft-candles
Floor Fraction (ALFF)	0.90		
Connected Load	9.7 W/m²	0.9	W/ft²
Occ. Period(Hrs./yr.)	2900		
Unocc. Period(Hrs./yr.)	5860		
Usage During Occupied Period	25%		
Usage During Unoccupied Period	20%		
Fixture Cleaning:			
Incidence of Practice			
Interval	years		
Relamping Strategy & Incidence of Practice	Group	Spot	

Light Level (Lux)	50	200	300	500				Total
% Distribution	60%	20%	20%	0%				100%
Weighted Average								**130**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	30%	70%					0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	1.5
	MJ/m².yr	60

SPECIAL PURPOSE LIGHTING

Light Level	0.00 Lux	0.0	ft-candles
Floor Fraction (HBLFF)	0.00		
Connected Load	0.0 W/m²	0.0	W/ft²
Occ. Period(Hrs./yr.)	4000		
Unocc. Period(Hrs./yr.)	4760		
Usage During Occupied Period	0%		
Usage During Unoccupied Period	100%		
Fixture Cleaning:			
Incidence of Practice			
Interval	years		
Relamping Strategy & Incidence of Practice	Group	Spot	

Floor fraction check: should = 1.00 | 1.00

Light Level (Lux)	300	500	700	1000				Total
% Distribution		0%	0%	0%				0%
Weighted Average								**0**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)								0.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	0.0
	MJ/m².yr	0

TOTAL LIGHTING	Overall LPD	9.16 W/m²	EUI TOTAL	kWh/ft².yr	1.8
		0.85 W/ft²		MJ/m².yr	71

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Servers	Plug Loads
Measured Power (W/device)	45	57	100	200	50	
Density (device/occupant)	0.8	0.8	0	0	0.00	
Connected Load	0.9 W/m²	1.1 W/m²	0.0 W/m²	0.0 W/m²	0.5 W/m²	1.8 W/m²
	0.1 W/ft²	0.1 W/ft²	0.00 W/ft²	0.00 W/ft²	0.05 W/ft²	0.17 W/ft²
Diversity Occupied Period	0%	0%	90%	90%	100%	40%
Diversity Unoccupied Period	50%	50%	50%	10%	100%	85%
Operation Occ. Period (hrs./year)	2900	2900	2600	2600	2600	3000
Operation Unocc. Period (hrs./year)	5860	5860	6160	6160	6160	5760

Total end-use load (occupied period)	1.2 W/m²	0.1 W/ft²
Total end-use load (unocc. period)	3.1 W/m²	0.3 W/ft²
Usage during occupied period	100%	
Usage during unoccupied period	249%	

Computer Equipment	EUI	kWh/ft².yr	0.98
		MJ/m².yr	37.77
Plug Loads	EUI	kWh/ft².yr	1.02
		MJ/m².yr	39.50

FOOD SERVICE EQUIPMENT

Provide description below:

Electric stoves (at 417 kWh/yr), etc.

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	0.3	EUI	kWh/ft².yr	0.7
	MJ/m².yr	10.0		MJ/m².yr	27.0

REFRIGERATION

Provide description below:

Residential refrigerators (560 kWh/yr) and freezers (370 kWh/yr)

EUI	kWh/ft².yr	0.7
	MJ/m².yr	26.0

MISCELLANEOUS

Provide description below:

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	1.0	EUI	kWh/ft².yr	0.4
	MJ/m².yr	40.0		MJ/m².yr	15.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Large High Rise	**> 9,300 m² (100,000 ft²)**		**Inland North**
Baseline			

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	5%	30%	10%	25%	15%	0%	3%	3%	9%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff. (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	38.4	W/m²	12.2	Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	386	MJ/m².yr	10.0	kWh/ft².yr
Sizing Factor	1.00			
Electric Fuel Share	15.0%	Fossil Fuel Share	85.0%	

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	7.8
MJ/m².yr	303

Gas EUI	
kWh/ft².yr	12.6
MJ/m².yr	488

Market Composite EUI	
kWh/ft².yr	11.9
MJ/m².yr	460

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	1.0%	0.0%		5.0%	94.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7	°C	44.6	°F
Condenser Water	30	°C	86	°F
Supply Air	13.0	°C	55.4	°F

Peak Cooling Load	6	W/m²	2	Btu/hr.ft²	6297	ft²/Ton
Seasonal Cooling Load (Tertiary Load)	56.5	MJ/m².yr	1.5	kWh/ft².yr		

Sizing Factor: 0.15 — Operation (occ. period): 3000 hrs/year — Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C): 15.0%

Electric Fuel Share: 100.0% — Gas Fuel Share: 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenan

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	0.4
MJ/m².yr	15

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	0.4
MJ/m².yr	15

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	25%				50%
Eff./COP	0.65				0.75

	Fossil		Elec. Res.
Fuel Share	75%		25%
Blended Efficiency	0.72		1.00

Service Hot Water load (MJ/m².yr) (Tertiary Load): 200.0

Wetting Use Percentage: 80%

All Electric EUI	
kWh/ft².yr	5.2
MJ/m².yr	200

Fossil Fuel EUI	
kWh/ft².yr	7.2
MJ/m².yr	279

Market Composite EUI	
kWh/ft².yr	6.7
MJ/m².yr	259.3

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **Large High Rise** **Baseline**
SIZE: **> 9,300 m² (100,000 ft²)**
VINTAGE:
REGION: **Inland North**

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	0.3	L/s.m²	0.05	CFM/ft²
System Static Pressure CAV	625	Pa	2.5	wg
System Static Pressure VAV	0	Pa	0.0	wg
Fan Efficiency	52%			
Fan Motor Efficiency	90%			
Sizing Factor	1.00			
Fan Design Load CAV	0.3	W/m²	0.03	W/ft²
Fan Design Load VAV	0.0	W/m²	0.00	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	100%	0%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	75%	25%	75%	25%
Comments:				

EXHAUST FANS

Washroom Exhaust	50	L/s.washroom	106	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m²	0.02	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.2	L/s.m²	0.04	CFM/ft²
Exhaust System Static Pressure	125	Pa	0.5	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.1	W/m²	0.01	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.000	kW/kW	0.00	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	0.00	W/m²	0.00	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.000	L/s.m²	0.000	U.S. gpm/ft²
Pump Head Pressure	0	kPa	0	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.00	W/m²	0.00	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.000	L/s.m²	0.0004	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.1	W/m²	0.00	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	2.5	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	0.9	kWh/m².yr
Condenser Pump Energy Consumption	0.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.0	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	0.3	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI	kWh/ft².yr	0.3
	MJ/m².yr	13.3

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Large High Rise	**> 9,300 m² (100,000 ft²)**		**Inland North**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**9.2**	kWh/ft².yr	**356.2**	MJ/m².yr	**Fossil Fue**	**17.4**	kWh/ft².yr	**673.7**	MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL (Linear Fluorescent) LIGHT	0.3	11.7
ARCHITECTURAL (Incandescent & re	1.5	59.7
SPECIAL PURPOSE LIGHTING	0.0	0.0
OTHER PLUG LOADS	1.0	39.5
HVAC FANS & PUMPS	0.3	13.3
REFRIGERATION	0.7	26.0
COMPUTER EQUIPMENT	1.0	37.8
ELEVATORS	0.3	11.6
OUTDOOR LIGHTING	0.4	17.0

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	1.2	45.4	10.7	414.4
SPACE COOLING	0.1	2.3	0.0	0.0
DOMESTIC HOT WATER	1.3	50.0	5.4	209.3
FOOD SERVICE EQUIPMENT	0.7	27.0	0.3	10.0
MISCELLANEOUS	0.4	15.0	1.0	40.0

COMMERCIAL SECTOR BUILDING PROFILE

New BUILDINGS: | **SIZE:** | **VINTAGE:** | **REGION:**
Medium Apartment | | | **Inland South**
Baseline

CONSTRUCTION

Wall U value (W/m².°C)	0.81	W/m².°C	0.14	Btu/hr.ft².°F	Typical Building Size	8,000	m²	86,080	ft²
Roof U value (W/m².°C)	0.34	W/m².°C	0.06	Btu/hr.ft².°F	Typical Footprint (m²)	1,600	m²	17,216	ft²
Glazing U value (W/m².°C)	3.50	W/m².°C	0.62	Btu/hr.ft².°F	Footprint Aspect Ratio (L:W)	3			
					Percent Conditioned Space	100%			
					Percent Conditioned Space Defined as Exterior Zone	45%			
Window/Wall Ratio (WIWAR) (%)	0.25								
Shading Coefficient (SC)	0.65				Typical # Stories	5			
					Floor to Floor Height (m)	3.7	m	12.0	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	100%		0%		0%		0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	40	m²/person	430	ft²/person
Occupancy Schedule Occ. Period	25%			
Occupancy Schedule Unocc. Period	80%			
Fresh Air Requirements or Outside Air	10	L/s.person	21	CFM/person

%OA 100.00%

Fresh Air Control Type *(enter a 1, 2 or 3) 3
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right: 0%
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation 0.25 L/s.m² 0.05 CFM/ft²
75% operation (%)

Sizing Factor	1			
Total Air Circulation or Design Air Flow	0.25	L/s.m²	0.05	CFM/ft²
Infiltration Rate	0.05	L/s.m²	0.01	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA) L/s.m² 0.00 CFM/ft²
Operation occupied period 50%
Operation unoccupied period 50%

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	1,228,619	
Peak Zone Sensible Load	823,601	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	38,314	
Total air circulation or Design air	2.26	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	23	°C	73.4	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	20.4	°C	68.72	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

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COMMERCIAL SECTOR BUILDING PROFILE

New BUILDINGS: **SIZE:** **VINTAGE:** **REGION:**
Medium Apartment **Inland South**
Baseline

LIGHTING

GENERAL (Linear Fluorescent) LIGHTING

Light Level	160	Lux	14.9	ft-candles
Floor Fraction (GLFF)	0.10			
Connected Load	4.1	W/m²	0.4	W/ft²

Occ. Period(Hrs./yr.)	3400
Unocc. Period(Hrs./yr.)	5360
Usage During Occupied Period	90%
Usage During Unoccupied Period	90%

Light Level (Lux)	50	100	200	300	Total
% Distribution	0%	60%	20%	20%	100%
Weighted Average					**160**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			0.0%	0%	100.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

Fixture Cleaning:
Incidence of Practice
Interval years

Relamping Strategy & Incidence of Practice: Group | Spot

EUI	kWh/ft².yr	0.3
	MJ/m².yr	12

ARCHITECTURAL (Incandescent & replacements) LIGHTING

Light Level	130	Lux	12.1	ft-candles
Floor Fraction (ALFF)	0.90			
Connected Load	9.7	W/m²	0.9	W/ft²

Occ. Period(Hrs./yr.)	2900
Unocc. Period(Hrs./yr.)	5860
Usage During Occupied Period	25%
Usage During Unoccupied Period	20%

Light Level (Lux)	50	200	300	500	Total
% Distribution	60%	20%	20%	0%	100%
Weighted Average					**130**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	30%	70%					0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

Fixture Cleaning:
Incidence of Practice
Interval years

Relamping Strategy & Incidence of Practice: Group | Spot

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	1.5
	MJ/m².yr	60

SPECIAL PURPOSE LIGHTING

Light Level	0.00	Lux	0.0	ft-candles
Floor Fraction (HBLFF)	0.00			
Connected Load	0.0	W/m²	0.0	W/ft²

Floor fraction check: should = 1.00 | 1.00

Occ. Period(Hrs./yr.)	4000
Unocc. Period(Hrs./yr.)	4760
Usage During Occupied Period	0%
Usage During Unoccupied Period	100%

Light Level (Lux)	300	500	700	1000	Total
% Distribution		0%	0%	0%	0%
Weighted Average					**0**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)								0.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

Fixture Cleaning:
Incidence of Practice
Interval years

Relamping Strategy & Incidence of Practice: Group | Spot

EUI	kWh/ft².yr	0.0
	MJ/m².yr	0

TOTAL LIGHTING

Overall LPD 9.16 W/m²
0.85 W/ft²

EUI TOTAL	kWh/ft².yr	1.8
	MJ/m².yr	71

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Servers		Plug Loads	
Measured Power (W/device)	45		57		100		200		50			
Density (device/occupant)	0.8		0.8		0		0		0.00			
Connected Load	0.9	W/m²	1.1	W/m²	0.0	W/m²	0.0	W/m²	0.5	W/m²	1.8	W/m²
	0.1	W/ft²	0.1	W/ft²	0.00	W/ft²	0.00	W/ft²	0.05	W/ft²	0.17	W/ft²
Diversity Occupied Period	0%		0%		90%		90%		100%		40%	
Diversity Unoccupied Period	50%		50%		50%		10%		100%		85%	
Operation Occ. Period (hrs./year)	2900		2900		2600		2600		2600		3000	
Operation Unocc. Period (hrs./year)	5860		5860		6160		6160		6160		5760	

Total end-use load (occupied period)	1.2	W/m²	0.1	W/ft²
Total end-use load (unocc. period)	3.1	W/m²	0.3	W/ft²

Usage during occupied period 100%
Usage during unoccupied period 249%

Computer Equipment	EUI	kWh/ft².yr	0.98
		MJ/m².yr	37.77
Plug Loads	EUI	kWh/ft².yr	1.02
		MJ/m².yr	39.50

FOOD SERVICE EQUIPMENT

Provide description below:
Electric stoves (at 417 kWh/yr), etc.

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	0.1	EUI	kWh/ft².yr	0.7
	MJ/m².yr	5.0		MJ/m².yr	27.0

REFRIGERATION

Provide description below:
Residential refrigerators (560 kWh/yr) and freezers (370 kWh/yr)

EUI	kWh/ft².yr	0.7
	MJ/m².yr	26.0

MISCELLANEOUS

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	0.8	EUI	kWh/ft².yr	0.0
	MJ/m².yr	30.0		MJ/m².yr	

COMMERCIAL SECTOR BUILDING PROFILE

New BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Apartment			Inland South
Baseline			

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	5%	30%	10%	20%	15%	0%	3%	3%	14%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff. (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load: 20.9 W/m² — 6.6 Btu/hr.ft²
Seasonal Heating Load (Tertiary Load): 286 MJ/m².yr — 7.4 kWh/ft².yr
Sizing Factor: 1.00

Electric Fuel Share: 20.0% — Fossil Fuel Share: 80.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	6.2
MJ/m².yr	240

Gas EUI	
kWh/ft².yr	9.3
MJ/m².yr	360

Market Composite EUI	
kWh/ft².yr	8.7
MJ/m².yr	336

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	1.0%	0.0%		5.0%	94.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7	°C	44.6	°F
Condenser Water	30	°C	86	°F
Supply Air	14.0	°C	57.2	°F

Peak Cooling Load: 7 W/m² — 2 Btu/hr.ft² — 5605 ft²/Ton
Seasonal Cooling Load (Tertiary Load): 92.1 MJ/m².yr — 2.4 kWh/ft².yr

Sizing Factor: 0.15 — Operation (occ. period): 3000 hrs/year — Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C): 15.0%

Electric Fuel Share: 100.0% — Gas Fuel Share: 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	0.6
MJ/m².yr	23

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	0.6
MJ/m².yr	23

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	60%				20%
Eff./COP	0.65				0.75

	Fossil		Elec. Res.
Fuel Share	80%		20%
Blended Efficiency	0.68		1.00

Service Hot Water load (MJ/m².yr) (Tertiary Load): 180.0

Wetting Use Percentage: 80%

All Electric EUI	
kWh/ft².yr	4.6
MJ/m².yr	180

Fossil Fuel EUI	
kWh/ft².yr	6.9
MJ/m².yr	267

Market Composite EUI	
kWh/ft².yr	6.4
MJ/m².yr	249.3

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New BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Apartment			Inland South
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	0.3	L/s.m²	0.05	CFM/ft²
System Static Pressure CAV	625	Pa	2.5	wg
System Static Pressure VAV	0	Pa	0.0	wg
Fan Efficiency	52%			
Fan Motor Efficiency	90%			
Sizing Factor	1.00			
Fan Design Load CAV	0.3	W/m²	0.03	W/ft²
Fan Design Load VAV	0.0	W/m²	0.00	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	100%	0%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	75%	25%	75%	25%

Comments:

EXHAUST FANS

Washroom Exhaust	50	L/s.washroom	106	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m²	0.01	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.2	L/s.m²	0.03	CFM/ft²
Exhaust System Static Pressure	125	Pa	0.5	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.1	W/m²	0.01	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.000	kW/kW	0.00	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	0.00	W/m²	0.00	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.000	L/s.m²	0.001	U.S. gpm/ft²
Pump Head Pressure	0	kPa	0	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.00	W/m²	0.00	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.000	L/s.m²	0.0004	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.1	W/m²	0.01	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	2.5	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	0.8	kWh/m².yr
Condenser Pump Energy Consumption	0.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.0	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	0.3	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI	kWh/ft².yr	0.3
	MJ/m².yr	12.9

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COMMERCIAL SECTOR BUILDING PROFILE

New BUILDINGS: **SIZE:** **VINTAGE:** **REGION:**
Medium Apartment **Inland South**
Baseline

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**8.5** kWh/ft².yr	**330.6** MJ/m².yr	**Fossil Fue**	**13.8** kWh/ft².yr	**536.2** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL (Linear Fluorescent) LIGHT	0.3	11.7
ARCHITECTURAL (Incandescent & re	1.5	59.7
SPECIAL PURPOSE LIGHTING	0.0	0.0
OTHER PLUG LOADS	1.0	39.5
HVAC FANS & PUMPS	0.3	12.9
REFRIGERATION	0.7	26.0
COMPUTER EQUIPMENT	1.0	37.8
ELEVATORS	0.3	11.6
OUTDOOR LIGHTING	0.4	17.0

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	1.2	47.9	7.4	287.8
SPACE COOLING	0.1	3.4	0.0	0.0
DOMESTIC HOT WATER	0.9	36.0	5.5	213.3
FOOD SERVICE EQUIPMENT	0.7	27.0	0.1	5.0
MISCELLANEOUS	0.0	0.0	0.8	30.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Office	> 9,300 m² (100,000 ft²)		Inland South
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.88	W/m².°C	0.15	Btu/hr.ft² . °F	Typical Building Size	21,365	m²	229,887	ft²
Roof U value (W/m².°C)	0.34	W/m².°C	0.06	Btu/hr.ft² . °F	Typical Footprint (m²)	1,526	m²	16,421	ft²
Glazing U value (W/m².°C)	3.50	W/m².°C	0.62	Btu/hr.ft² . °F	Footprint Aspect Ratio (L:W)	1			
					Percent Conditioned Space	100%			
					Percent Conditioned Space Defined as Exterior Zone	45%			
Window/Wall Ratio (WIWAR) (%)	0.60								
Shading Coefficient (SC)	0.40				Typical # Stories	14			
					Floor to Floor Height (m)	3.7	m	12.0	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	50%		0%		50%		0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	26	m²/person	274	ft²/person	%OA	13.96%
Occupancy Schedule Occ. Period	90%					
Occupancy Schedule Unocc. Period	0%					
Fresh Air Requirements or Outside Air	20	L/s.person	42	CFM/person		

Fresh Air Control Type *(enter a 1, 2 or 3) (1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air): 1

If Fresh Air Control Type = "2" enter % FA. to the right: 34%

If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation: 0.5 L/s.m² | 0.10 CFM/ft² | 50% operation (%)

Sizing Factor	1.7			
Total Air Circulation or Design Air Flow	5.62	L/s.m²	1.11	CFM/ft²
Infiltration Rate (air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)	0.19	L/s.m²	0.04	CFM/ft²

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	6,694,937	
Peak Zone Sensible Load	3,216,177	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	149,616	
Total air circulation or Design air	5.62	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	24	°C	75.2	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	20.4	°C	68.72	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning — Changes/Year:

Incidence of Annual Room Controls Maintenance:

Incidence of Annual HVAC Controls Maintenance:

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Large Office	**> 9,300 m² (100,000 ft²)**		**Inland South**
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	440	Lux	40.9	ft-candles
Floor Fraction (GLFF)	0.95			
Connected Load	11.4	W/m²	1.1	W/ft²
Occ. Period(Hrs./yr.)	2900			
Unocc. Period(Hrs./yr.)	5860			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	25%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	300	500	700	1000				Total
% Distribution	30%	70%	0%	0%				100%
Weighted Average								**440**
	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)					100.0%			100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	4.2
	MJ/m².yr	164

ARCHITECTURAL LIGHTING

Light Level	300	Lux	27.9	ft-candles
Floor Fraction (ALFF)	0.05			
Connected Load	20.9	W/m²	1.9	W/ft²
Occ. Period(Hrs./yr.)	3400			
Unocc. Period(Hrs./yr.)	5360			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	50%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	300	500	700	1000				Total
% Distribution	100%	0%	0%	0%				100%
Weighted Average								**300**
	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	25%	75%					0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	0.6
	MJ/m².yr	22

SPECIAL PURPOSE LIGHTING

Light Level	0.00	Lux	0.0	ft-candles
Floor Fraction (HBLFF)	0.00			
Connected Load	0.0	W/m²	0.0	W/ft²
Occ. Period(Hrs./yr.)	4000			
Unocc. Period(Hrs./yr.)	4760			
Usage During Occupied Period	0%			
Usage During Unoccupied Period	100%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 | 1.00

Light Level (Lux)	300	500	700	1000				Total
% Distribution		0%	0%	0%				0%
Weighted Average								**0**
	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)								0.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	0.0
	MJ/m².yr	0

TOTAL LIGHTING

Overall LPD	11.84 W/m²	EUI TOTAL	kWh/ft².yr	4.8
	1.10 W/ft²		MJ/m².yr	186

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Servers	Plug Loads
Measured Power (W/device)	55	51	100	200	217	
Density (device/occupant)	0.9	0.9	0.15	0.1	0.06	
Connected Load	1.9 W/m²	1.8 W/m²	0.6 W/m²	0.8 W/m²	0.5 W/m²	2.5 W/m²
	0.2 W/ft²	0.2 W/ft²	0.05 W/ft²	0.07 W/ft²	0.05 W/ft²	0.23 W/ft²
Diversity Occupied Period	90%	90%	90%	90%	100%	90%
Diversity Unoccupied Period	50%	50%	50%	50%	100%	25%
Operation Occ. Period (hrs./year)	2500	2500	2500	2500	2500	3000
Operation Unocc. Period (hrs./year)	6260	6260	6260	6260	6260	5760

Total end-use load (occupied period)	7.3 W/m²	0.7 W/ft²
Total end-use load (unocc. period)	3.7 W/m²	0.3 W/ft²
Usage during occupied period	100%	
Usage during unoccupied period	50%	

Computer Equipment	EUI	kWh/ft².yr	2.96
		MJ/m².yr	114.76
Plug Loads	EUI	kWh/ft².yr	0.96
		MJ/m².yr	37.26

FOOD SERVICE EQUIPMENT

Provide description below:

Cafeteria

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	0.3	EUI	kWh/ft².yr	0.1
	MJ/m².yr	10.0		MJ/m².yr	3.0

REFRIGERATION

Provide description below:

Unknown

EUI	kWh/ft².yr	0.1
	MJ/m².yr	4.0

MISCELLANEOUS

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	0.3	EUI	kWh/ft².yr	0.0
	MJ/m².yr	10.0		MJ/m².yr	0.0

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Office	> 9,300 m² (100,000 ft²)		Inland South
Baseline			

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	35%	35%	15%	10%	0%	0%	1%	1%	3%	0%	100%
Seasonal Eff./COP	75%	80%	90%	77%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff. (kW/kW)	1.33	1.25	1.11	1.30	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	32.4	W/m²	10.3	Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	277	MJ/m².yr	7.2	kWh/ft².yr
Sizing Factor	1.00			
Electric Fuel Share	5.0%	Fossil Fuel Share	95.0%	

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	kWh/ft².yr	5.6
	MJ/m².yr	218
Gas EUI	kWh/ft².yr	9.0
	MJ/m².yr	351
Market Composite EUI	kWh/ft².yr	8.9
	MJ/m².yr	344

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	0.0%	70.0%	20.0%	5.0%	5.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7	°C	44.6	°F
Condenser Water	30	°C	86	°F
Supply Air	14.0	°C	57.2	°F

Peak Cooling Load	92	W/m²	29	Btu/hr.ft²	412	ft²/Ton
Seasonal Cooling Load (Tertiary Load)	180.5	MJ/m².yr	4.7	kWh/ft².yr		

Sizing Factor 1.00 — Operation (occ. period) 3000 hrs/year — Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C) 90.0%

Electric Fuel Share 100.0% — Gas Fuel Share 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenan

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	kWh/ft².yr	1.7
	MJ/m².yr	65
Natural Gas EUI	kWh/ft².yr	0.0
	MJ/m².yr	0
Market Composite EUI	kWh/ft².yr	1.7
	MJ/m².yr	65

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	40%				30%
Eff./COP	0.65				0.80

	Fossil	Elec. Res.
Fuel Share	70%	30%
Blended Efficiency	0.71	0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 35.0

Wetting Use Percentage 90%

	All Electric EUI	Fossil Fuel EUI	Market Composite EUI
kWh/ft².yr	1.0	1.3	1.2
MJ/m².yr	38	49	45.8

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Office	> 9,300 m² (100,000 ft²)		Inland South
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	5.6	L/s.m²	1.11	CFM/ft²
System Static Pressure CAV	900	Pa	3.6	wg
System Static Pressure VAV	900	Pa	3.6	wg
Fan Efficiency	52%			
Fan Motor Efficiency	85%			
Sizing Factor	1.00			
Fan Design Load CAV	11.4	W/m²	1.06	W/ft²
Fan Design Load VAV	11.4	W/m²	1.06	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	50%	50%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	50%	50%	100%	0%

Comments:

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m²	0.03	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.2	L/s.m²	0.05	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	80%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.3	W/m²	0.03	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.020	kW/kW	0.07	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	1.84	W/m²	0.17	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.005	L/s.m²	0.007	U.S. gpm/ft²
Pump Head Pressure	90	kPa	30	ft
Pump Efficiency	55%			
Pump Motor Efficiency	85%			
Sizing Factor	1.0			
Pump Connected Load	0.94	W/m²	0.09	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.004	L/s.m²	0.0058	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	150	kPa	50	ft		
Pump Efficiency	55%					
Pump Motor Efficiency	85%					
Sizing Factor	0.8					
Pump Connected Load	1.0	W/m²	0.09	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	56.9	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	2.5	kWh/m².yr
Condenser Pump Energy Consumption	1.9	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.9	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	5.1	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI		
	kWh/ft².yr	6.3
	MJ/m².yr	242.4

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Large Office	**> 9,300 m² (100,000 ft²)**		**Inland South**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**18.0** kWh/ft².yr	**696.8** MJ/m².yr	**Fossil Fuel**	**10.0** kWh/ft².yr	**387.3** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	4.2	164.0
ARCHITECTURAL LIGHTING	0.6	22.2
SPECIAL PURPOSE LIGHTING	0.0	0.0
OTHER PLUG LOADS	1.0	37.3
HVAC FANS & PUMPS	6.3	242.4
REFRIGERATION	0.1	4.0
COMPUTER EQUIPMENT	3.0	114.8
ELEVATORS	0.3	11.6
OUTDOOR LIGHTING	0.4	17.0

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.3	10.9	8.6	333.0
SPACE COOLING	1.5	58.1	0.0	0.0
DOMESTIC HOT WATER	0.3	11.5	0.9	34.3
FOOD SERVICE EQUIPMENT	0.1	3.0	0.3	10.0
MISCELLANEOUS	0.0	0.0	0.3	10.0

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Office	50,000 to 100,000 ft^2		Inland South
Baseline			

CONSTRUCTION

Wall U value (W/m^2.°C)	0.89	W/m^2.°C	0.16	Btu/hr.ft^2 . °F
Roof U value (W/m^2.°C)	0.34	W/m^2.°C	0.06	Btu/hr.ft^2 . °F
Glazing U value (W/m^2.°C)	3.50	W/m^2.°C	0.62	Btu/hr.ft^2 . °F
Window/Wall Ratio (WIWAR) (%)	0.45			
Shading Coefficient (SC)	0.45			

Typical Building Size	6,777	m^2	72,921	ft^2
Typical Footprint (m^2)	753	m^2	8,102	ft^2
Footprint Aspect Ratio (L:W)	1			
Percent Conditioned Space	100%			
Percent Conditioned Space Defined as Exterior Zone	45%			
Typical # Stories	9			
Floor to Floor Height (m)	3.7	m	12.0	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	50%		0%		50%		0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	26	m^2/person	274	ft^2/person
Occupancy Schedule Occ. Period	90%			
Occupancy Schedule Unocc. Period	0%			
Fresh Air Requirements or Outside Air	20	L/s.person	42	CFM/person

%OA 12.33%

Fresh Air Control Type *(enter a 1, 2 or 3) 1
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right: 34%
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation 0.5 L/s.m^2 0.10 CFM/ft^2 50% operation (%)

Sizing Factor	1.6			
Total Air Circulation or Design Air Flow	6.36	L/s.m^2	1.25	CFM/ft^2
Infiltration Rate	0.19	L/s.m^2	0.04	CFM/ft^2

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0	L/s.m^2	0.00	CFM/ft^2
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based	Total
Incidence of Use	0%		100%	100%
Switchover Point		KJ/kg.	18 °C	
		Btu/lbm	64.4 °F	

Summary of Design Parameters		
Peak Design Cooling Load	2,330,343	
Peak Zone Sensible Load	1,226,877	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft^3/lbm
Design CFM	57,074	
Total air circulation or Design air	6.36	l/s.m^2

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	22	°C	71.6	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	20.4	°C	68.72	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Office	50,000 to 100,000 ft²		Inland South
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	460	Lux	42.8	ft-candles
Floor Fraction (GLFF)	0.98			
Connected Load	11.9	W/m²	1.1	W/ft²
Occ. Period(Hrs./yr.)	2900			
Unocc. Period(Hrs./yr.)	5860			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	25%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	300	500	700	1000	Total
% Distribution	20%	80%	0%	0%	100%
Weighted Average					**460**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			0.0%		100.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	4.6
	MJ/m².yr	177

ARCHITECTURAL LIGHTING

Light Level	300	Lux	27.9	ft-candles
Floor Fraction (ALFF)	0.02			
Connected Load	20.9	W/m²	1.9	W/ft²
Occ. Period(Hrs./yr.)	3400			
Unocc. Period(Hrs./yr.)	5360			
Usage During Occupied Period	100%			
Usage During Unoccupied Period	90%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	300	500	700	1000	Total
% Distribution	100%	0%	0%	0%	100%
Weighted Average					**300**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	25%	75%					0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	0.3
	MJ/m².yr	12

SPECIAL PURPOSE LIGHTING

Light Level	0.00	Lux	0.0	ft-candles
Floor Fraction (HBLFF)	0.00			
Connected Load	0.0	W/m²	0.0	W/ft²
Occ. Period(Hrs./yr.)	3400			
Unocc. Period(Hrs./yr.)	5360			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	40%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 | 1.00

Light Level (Lux)	300	500	700	1000	Total
% Distribution		0%	0%	0%	0%
Weighted Average					**0**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)								0.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	0.0
	MJ/m².yr	0

TOTAL LIGHTING

Overall LPD	12.06 W/m²	EUI TOTAL	kWh/ft².yr	4.9
	1.12 W/ft²		MJ/m².yr	189

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Servers	Plug Loads
Measured Power (W/device)	55	51	100	200	217	
Density (device/occupant)	0.9	0.9	0.15	0.1	0.06	
Connected Load	1.9 W/m²	1.8 W/m²	0.6 W/m²	0.8 W/m²	0.5 W/m²	1 W/m²
	0.2 W/ft²	0.2 W/ft²	0.05 W/ft²	0.07 W/ft²	0.05 W/ft²	0.09 W/ft²
Diversity Occupied Period	90%	90%	90%	90%	100%	80%
Diversity Unoccupied Period	50%	50%	50%	50%	100%	25%
Operation Occ. Period (hrs./year)	2500	2500	2500	2500	2500	2500
Operation Unocc. Period (hrs./year)	6260	6260	6260	6260	6260	6260

Total end-use load (occupied period)	5.9 W/m²	0.5 W/ft²
Total end-use load (unocc. period)	3.3 W/m²	0.3 W/ft²
Usage during occupied period	100%	
Usage during unoccupied period	56%	

Computer Equipment	EUI	kWh/ft².yr	2.96
		MJ/m².yr	114.76
Plug Loads	EUI	kWh/ft².yr	0.33
		MJ/m².yr	12.83

FOOD SERVICE EQUIPMENT

Provide description below:

Lunch room/cafeteria/restaurant

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	0.3	EUI	kWh/ft².yr	0.1
	MJ/m².yr	10.0		MJ/m².yr	3.0

REFRIGERATION

Provide description below:

Lunch room/cafeteria/restaurant

EUI	kWh/ft².yr	0.1
	MJ/m².yr	4.0

MISCELLANEOUS

Provide description below:

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	0.5	EUI	kWh/ft².yr	0.0
	MJ/m².yr	20.0		MJ/m².yr	

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Office	50,000 to 100,000 ft²		Inland South
Baseline			

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	5%	35%	10%	45%	0%	0%	2%	1%	2%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff.) (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	39.1 W/m²	12.4 Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	340 MJ/m².yr	8.8 kWh/ft².yr
Sizing Factor	1.00	
Electric Fuel Share	5.0%	Fossil Fuel Share 95.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	6.2
MJ/m².yr	239

Gas EUI	
kWh/ft².yr	11.2
MJ/m².yr	435

Market Composite EUI	
kWh/ft².yr	11.0
MJ/m².yr	425

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	0.0%	5.0%	20.0%	5.0%	70.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7 °C	44.6 °F
Condenser Water	30 °C	86 °F
Supply Air	14.0 °C	57.2 °F

Peak Cooling Load	101 W/m²	32 Btu/hr.ft²	376 ft²/Ton
Seasonal Cooling Load (Tertiary Load)	203.3 MJ/m².yr	5.2 kWh/ft².yr	

Sizing Factor 1.00 — Operation (occ. period) 3000 hrs/year Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C) 80.0%

Electric Fuel Share 100.0% — Gas Fuel Share 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenan

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	2.3
MJ/m².yr	89

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	2.3
MJ/m².yr	89

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	60%				10%
Eff./COP	0.65				0.75

	Fossil		Elec. Res.
Fuel Share	70%		30%
Blended Efficiency	0.66		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 30.0

Wetting Use Percentage 90%

All Electric EUI	
kWh/ft².yr	0.9
MJ/m².yr	33

Fossil Fuel EUI	
kWh/ft².yr	1.2
MJ/m².yr	45

Market Composite EUI	
kWh/ft².yr	1.1
MJ/m².yr	41.5

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Medium Office	**50,000 to 100,000 ft²**		**Inland South**
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	6.4	L/s.m²	1.25	CFM/ft²
System Static Pressure CAV	850	Pa	3.4	wg
System Static Pressure VAV	850	Pa	3.4	wg
Fan Efficiency	52%			
Fan Motor Efficiency	88%			
Sizing Factor	1.00			
Fan Design Load CAV	11.8	W/m²	1.10	W/ft²
Fan Design Load VAV	11.8	W/m²	1.10	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	50%	50%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	50%	50%	50%	50%

Comments:

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.3	L/s.m²	0.05	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.4	L/s.m²	0.07	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.5	W/m²	0.05	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.020	kW/kW	0.07	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	2.02	W/m²	0.19	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.005	L/s.m²	0.008	U.S. gpm/ft²
Pump Head Pressure	45	kPa	15	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.60	W/m²	0.06	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.004	L/s.m²	0.0064	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.9	W/m²	0.08	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	58.8	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	3.0	kWh/m².yr
Condenser Pump Energy Consumption	0.5	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	1.0	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	4.3	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI	kWh/ft².yr	6.3
	MJ/m².yr	243.6

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Office	50,000 to 100,000 ft²		Inland South
Baseline			

EUI SUMMARY

TOTAL ALL END-USES: **Electricity:** **18.2** kWh/ft².yr **704.2** MJ/m².yr **Fossil Fuel** **12.3** kWh/ft².yr **474.8** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	4.6	176.9
ARCHITECTURAL LIGHTING	0.3	12.4
SPECIAL PURPOSE LIGHTING	0.0	0.0
OTHER PLUG LOADS	0.3	12.8
HVAC FANS & PUMPS	6.3	243.6
REFRIGERATION	0.1	4.0
COMPUTER EQUIPMENT	3.0	114.8
ELEVATORS	0.3	11.6
OUTDOOR LIGHTING	0.8	32.2

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.3	11.9	10.7	413.2
SPACE COOLING	1.8	71.0	0.0	0.0
DOMESTIC HOT WATER	0.3	9.9	0.8	31.6
FOOD SERVICE EQUIPMENT	0.1	3.0	0.3	10.0
MISCELLANEOUS	0.0	0.0	0.5	20.0

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Large Retail	**> 100,000 ft²**		**Inland South**
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.66	W/m².°C	0.12	Btu/hr.ft² . °F	Typical Building Size	24,000	m²	258,240	ft²
Roof U value (W/m².°C)	0.34	W/m².°C	0.06	Btu/hr.ft² . °F	Typical Footprint (m²)	24,000	m²	258,240	ft²
Glazing U value (W/m².°C)	3.50	W/m².°C	0.62	Btu/hr.ft² . °F	Footprint Aspect Ratio (L:W)	15			
					Percent Conditioned Space	100%			
					Percent Conditioned Space Defined as Exterior Zone	40%			
Window/Wall Ratio (WIWAR) (%)	0.10								
Shading Coefficient (SC)	0.78				Typical # Stories	1			
					Floor to Floor Height (m)	4.6	m	15.0	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	80%		0%		20%		0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	45	m²/person	484	ft²/person	%OA	17.33%
Occupancy Schedule Occ. Period	90%					
Occupancy Schedule Unocc. Period	0%					
Fresh Air Requirements or Outside Air	50	L/s.person	106	CFM/person		

Fresh Air Control Type *(enter a 1, 2 or 3) | 1 | If Fresh Air Control Type = "2" enter % FA. to the right: | 0%
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air) | If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation | 0.5 L/s.m² | 0.10 CFM/ft²
50% operation (%)

Sizing Factor	2.3			
Total Air Circulation or Design Air Flow	6.41	L/s.m²	1.26	CFM/ft²
Infiltration Rate	0.38	L/s.m²	0.07	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	8,400,011	
Peak Zone Sensible Load	3,047,554	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	141,772	
Total air circulation or Design air	6.41	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	23	°C	73.4	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	20.4	°C	68.72	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning — Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Retail	> 100,000 ft²		Inland South
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	590	Lux	54.8	ft-candles
Floor Fraction (GLFF)	0.60			
Connected Load	15.2	W/m²	1.4	W/ft²
Occ. Period(Hrs./yr.)	4100			
Unocc. Period(Hrs./yr.)	4660			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	20%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	500	600	700	800				Total
% Distribution	10%	90%	0%	0%				100%
Weighted Average								**590**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)					100.0%			100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	4.1
	MJ/m².yr	159

ARCHITECTURAL LIGHTING

Light Level	575	Lux	53.4	ft-candles
Floor Fraction (ALFF)	0.15			
Connected Load	60.7	W/m²	5.6	W/ft²
Occ. Period(Hrs./yr.)	4100			
Unocc. Period(Hrs./yr.)	4660			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	30%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	400	500	600	700				Total
% Distribution	0%	25%	75%	0%				100%
Weighted Average								**575**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	60%	40%						100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	4.5
	MJ/m².yr	173

SPECIAL PURPOSE LIGHTING

Light Level	550.00	Lux	51.1	ft-candles
Floor Fraction (HBLFF)	0.25			
Connected Load	23.0	W/m²	2.1	W/ft²
Occ. Period(Hrs./yr.)	4100			
Unocc. Period(Hrs./yr.)	4660			
Usage During Occupied Period	100%			
Usage During Unoccupied Period	20%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 | 1.00

Light Level (Lux)	400	500	600	700				Total
% Distribution	0%	50%	50%	0%				100%
Weighted Average								**550**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)						100%		100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.7	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	2.7
	MJ/m².yr	104

TOTAL LIGHTING

Overall LPD	18.24 W/m²	EUI TOTAL	kWh/ft².yr	11.3
	1.70 W/ft²		MJ/m².yr	436

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Servers		Plug Loads	
Measured Power (W/device)	55		51		100		200		217			
Density (device/occupant)	0.648828		0.648828		0.01		0.01		0.03			
Connected Load	0.8	W/m²	0.7	W/m²	0.0	W/m²	0.0	W/m²	0.5	W/m²	1.75	W/m²
	0.1	W/ft²	0.1	W/ft²	0.00	W/ft²	0.00	W/ft²	0.05	W/ft²	0.16	W/ft²
Diversity Occupied Period	90%		90%		90%		90%		100%		90%	
Diversity Unoccupied Period	50%		50%		50%		50%		100%		25%	
Operation Occ. Period (hrs./year)	2000		2000		2600		2600		2600		4100	
Operation Unocc. Period (hrs./year)	6760		6760		6160		6160		6160		4660	

Total end-use load (occupied period)	3.5	W/m²	0.3	W/ft²
Total end-use load (unocc. period)	1.7	W/m²	0.2	W/ft²
Usage during occupied period	100%			
Usage during unoccupied period	50%			

Computer Equipment	EUI	kWh/ft².yr	1.18
		MJ/m².yr	45.81
Plug Loads	EUI	kWh/ft².yr	0.79
		MJ/m².yr	30.59

FOOD SERVICE EQUIPMENT

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	0.3	EUI	kWh/ft².yr	0.3
	MJ/m².yr	10.0		MJ/m².yr	10.0

REFRIGERATION

Provide description below:

EUI	kWh/ft².yr	0.3
	MJ/m².yr	10.0

MISCELLANEOUS

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	0.1	EUI	kWh/ft².yr	0.0
	MJ/m².yr	5.0		MJ/m².yr	0.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: Large Retail Baseline
SIZE: > 100,000 ft²
VINTAGE:
REGION: Inland South

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)		5%		87%	0%	0%	2%	1%	5%	0%	100%
Seasonal Eff./COP	75%	80%	85%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff. (kW/kW)	1.33	1.25	1.18	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	20.6 W/m²	6.5 Btu/hr.ft²	
Seasonal Heating Load (Tertiary Load)	158 MJ/m².yr	4.1 kWh/ft².yr	
Sizing Factor	1.00		
Electric Fuel Share	8.0%	Fossil Fuel Share	92.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	3.3
MJ/m².yr	129

Gas EUI	
kWh/ft².yr	5.4
MJ/m².yr	210

Market Composite EUI	
kWh/ft².yr	5.3
MJ/m².yr	204

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	0.0%	3.0%	0.0%	3.0%	94.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7 °C	44.6 °F
Condenser Water	30 °C	86 °F
Supply Air	14.0 °C	57.2 °F

Peak Cooling Load	103 W/m²	33 Btu/hr.ft²	369 ft²/Ton
Seasonal Cooling Load (Tertiary Load)	165.2 MJ/m².yr	4.3 kWh/ft².yr	

Sizing Factor 1.00 — Operation (occ. period) 3000 hrs/year Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C) 90.0%

Electric Fuel Share 100.0% — Gas Fuel Share 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	1.6
MJ/m².yr	63

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	1.6
MJ/m².yr	63

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	40%				10%
Eff./COP	0.65				0.75

	Fossil		Elec. Res.
Fuel Share	50%		50%
Blended Efficiency	0.67		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 30.0

Wetting Use Percentage 90%

All Electric EUI	
kWh/ft².yr	0.9
MJ/m².yr	33

Fossil Fuel EUI	
kWh/ft².yr	1.2
MJ/m².yr	45

Market Composite EUI	
kWh/ft².yr	1.0
MJ/m².yr	38.9

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Retail	> 100,000 ft²		Inland South
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	6.4	L/s.m²	1.26	CFM/ft²
System Static Pressure CAV	650	Pa	2.6	wg
System Static Pressure VAV	650	Pa	2.6	wg
Fan Efficiency	60%			
Fan Motor Efficiency	80%			
Sizing Factor	1.00			
Fan Design Load CAV	8.7	W/m²	0.81	W/ft²
Fan Design Load VAV	8.7	W/m²	0.81	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	80%	20%	50%	50%
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	50%	50%	50%	50%
Comments:				

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.0	L/s.m²	0.00	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.1	L/s.m²	0.02	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.1	W/m²	0.01	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.027	kW/kW	0.09	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	2.77	W/m²	0.26	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.005	L/s.m²	0.008	U.S. gpm/ft²
Pump Head Pressure	0	kPa	0	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.00	W/m²	0.00	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.004	L/s.m²	0.0065	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.9	W/m²	0.08	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	49.2	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	0.9	kWh/m².yr
Condenser Pump Energy Consumption	0.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	1.1	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	4.4	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI	kWh/ft².yr	5.2
	MJ/m².yr	200.1

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Retail	> 100,000 ft²		Inland South
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:				
Electricity:	22.7 kWh/ft².yr	878.3 MJ/m².yr		
Fossil Fuel	6.0 kWh/ft².yr	231.0 MJ/m².yr		

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	4.1	158.9
ARCHITECTURAL LIGHTING	4.5	173.4
SPECIAL PURPOSE LIGHTING	2.7	104.0
OTHER PLUG LOADS	0.8	30.6
HVAC FANS & PUMPS	5.2	200.1
REFRIGERATION	0.3	10.0
COMPUTER EQUIPMENT	1.2	45.8
ELEVATORS	0.3	11.6
OUTDOOR LIGHTING	1.3	50.9

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.3	10.3	5.0	193.7
SPACE COOLING	1.5	56.3	0.0	0.0
DOMESTIC HOT WATER	0.4	16.5	0.6	22.4
FOOD SERVICE EQUIPMENT	0.3	10.0	0.3	10.0
MISCELLANEOUS	0.0	0.0	0.1	5.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **Medium Retail** **Baseline**
SIZE: **50,000 - 100,000 ft2**
VINTAGE:
REGION: **Inland South**

CONSTRUCTION

Wall U value (W/m².°C)	0.59	W/m².°C	0.10	Btu/hr.ft² . °F	Typical Building Size	7,435 m²	80,000	ft²
Roof U value (W/m².°C)	0.32	W/m².°C	0.06	Btu/hr.ft² . °F	Typical Footprint (m²)	7,435 m²	80,000	ft²
Glazing U value (W/m².°C)	3.50	W/m².°C	0.62	Btu/hr.ft² . °F	Footprint Aspect Ratio (L:W)	5		
					Percent Conditioned Space	100%		
					Percent Conditioned Space Defined as Exterior Zone	45%		
Window/Wall Ratio (WIWAR) (%)	0.10							
Shading Coefficient (SC)	0.78				Typical # Stories	1		
					Floor to Floor Height (m)	5.0 m	16.5	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	100%		0%		0%		0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	25	m²/person	269	ft²/person
Occupancy Schedule Occ. Period	90%			
Occupancy Schedule Unocc. Period	0%			
Fresh Air Requirements or Outside Air	40	L/s.person	85	CFM/person

%OA 24.90%

Fresh Air Control Type *(enter a 1, 2 or 3) 1
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right: 34%
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation 0.5 L/s.m² 0.10 CFM/ft²
50% operation (%)

Sizing Factor	2			
Total Air Circulation or Design Air Flow	6.43	L/s.m²	1.27	CFM/ft²
Infiltration Rate	0.42	L/s.m²	0.08	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	3,489,286	
Peak Zone Sensible Load	1,087,923	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	50,610	
Total air circulation or Design air	6.43	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	21	°C	69.8	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	21	°C	69.8	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning   Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Retail	50,000 - 100,000 ft2		Inland South
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	590	Lux	54.8	ft-candles
Floor Fraction (GLFF)	0.55			
Connected Load	15.2	W/m²	1.4	W/ft²
Occ. Period(Hrs./yr.)	4100			
Unocc. Period(Hrs./yr.)	4660			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	20%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	500	600	700	800	Total
% Distribution	10%	90%	0%	0%	100%
Weighted Average					**590**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			0.0%	0%	100.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	3.8
	MJ/m².yr	146

ARCHITECTURAL LIGHTING

Light Level	575	Lux	53.4	ft-candles
Floor Fraction (ALFF)	0.15			
Connected Load	63.6	W/m²	5.9	W/ft²
Occ. Period(Hrs./yr.)	4100			
Unocc. Period(Hrs./yr.)	4660			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	35%			
Fixture Cleaning:				
Incidence of Practice	95%			
Interval	20%	years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	400	500	600	700	Total
% Distribution	0%	25%	75%	0%	100%
Weighted Average					**575**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	65%	35%					0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	4.9
	MJ/m².yr	190

SPECIAL PURPOSE LIGHTING

Light Level	550.00	Lux	51.1	ft-candles
Floor Fraction (HBLFF)	0.30			
Connected Load	23.0	W/m²	2.1	W/ft²
Occ. Period(Hrs./yr.)	4100			
Unocc. Period(Hrs./yr.)	4660			
Usage During Occupied Period	100%			
Usage During Unoccupied Period	15%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 | 1.00

Light Level (Lux)	400	500	600	700	Total
% Distribution	0%	50%	50%	0%	100%
Weighted Average					**550**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)						100%		100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.7	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	3.1
	MJ/m².yr	119

TOTAL LIGHTING

Overall LPD	17.92 W/m²	EUI TOTAL	kWh/ft².yr	11.7
	1.67 W/ft²		MJ/m².yr	454

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Servers		Plug Loads	
Measured Power (W/device)	55		51		100		200		217			
Density (device/occupant)	0.36046		0.36046		0.01		0.01		0.02			
Connected Load	0.8	W/m²	0.7	W/m²	0.0	W/m²	0.1	W/m²	0.5	W/m²	1.15	W/m²
	0.1	W/ft²	0.1	W/ft²	0.00	W/ft²	0.01	W/ft²	0.05	W/ft²	0.11	W/ft²
Diversity Occupied Period	90%		90%		90%		90%		100%		90%	
Diversity Unoccupied Period	50%		50%		50%		50%		100%		25%	
Operation Occ. Period (hrs./year)	2000		2000		2600		2600		2600		4100	
Operation Unocc. Period (hrs./year)	6760		6760		6160		6160		6160		4660	

Total end-use load (occupied period)	3.0	W/m²	0.3	W/ft²
Total end-use load (unocc. period)	1.6	W/m²	0.2	W/ft²
Usage during occupied period	100%			
Usage during unoccupied period	54%			

Computer Equipment	EUI	kWh/ft².yr	1.21
		MJ/m².yr	46.85
Plug Loads	EUI	kWh/ft².yr	0.52
		MJ/m².yr	20.10

FOOD SERVICE EQUIPMENT

Provide description below:

Small restaurants, food courts, kitchenettes

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	0.1	EUI	kWh/ft².yr	0.1
	MJ/m².yr	5.0		MJ/m².yr	5.0

REFRIGERATION

Provide description below:

EUI	kWh/ft².yr	0.2
	MJ/m².yr	8.6

MISCELLANEOUS

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	0.3	EUI	kWh/ft².yr	0.0
	MJ/m².yr	10.0		MJ/m².yr	0.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: Medium Retail Baseline
SIZE: 50,000 - 100,000 ft2
VINTAGE:
REGION: Inland South

SPACE HEATING

Heating Plant Type

							Electric			Other	
				Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	0%	2%	0%	60%	30%	0%	3%	0%	5%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff.) (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	17.5 W/m²	5.5 Btu/hr.ft²	
Seasonal Heating Load (Tertiary Load)	179 MJ/m².yr	4.6 kWh/ft².yr	
Sizing Factor	1.00		
Electric Fuel Share	8.0%	Fossil Fuel Share	92.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	3.9
MJ/m².yr	152

Gas EUI	
kWh/ft².yr	6.0
MJ/m².yr	234

Market Composite EUI	
kWh/ft².yr	5.9
MJ/m².yr	228

SPACE COOLING

A/C Plant Type

			WSHP			Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	0.0%	3.0%	0.0%	3.0%	94.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7 °C	44.6 °F
Condenser Water	30 °C	86 °F
Supply Air	14.0 °C	57.2 °F

Peak Cooling Load	138 W/m²	44 Btu/hr.ft²	275 ft²/Ton
Seasonal Cooling Load (Tertiary Load)	204.8 MJ/m².yr	5.3 kWh/ft².yr	

Sizing Factor 1.00 — Operation (occ. period) 3000 hrs/year Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C) 90.0%

Electric Fuel Share 100.0% — Gas Fuel Share 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenan

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	2.2
MJ/m².yr	86

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	2.2
MJ/m².yr	86

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	35%				10%
Eff./COP	0.65				0.75

	Fossil	Elec. Res.
Fuel Share	45%	55%
Blended Efficiency	0.67	0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 30.0

Wetting Use Percentage 90%

All Electric EUI	
kWh/ft².yr	0.9
MJ/m².yr	33

Fossil Fuel EUI	
kWh/ft².yr	1.2
MJ/m².yr	45

Market Composite EUI	
kWh/ft².yr	1.0
MJ/m².yr	38.2

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Retail	50,000 - 100,000 ft2		Inland South
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	6.4	L/s.m²	1.27	CFM/ft²
System Static Pressure CAV	500	Pa	2.0	wg
System Static Pressure VAV	500	Pa	2.0	wg
Fan Efficiency	60%			
Fan Motor Efficiency	88%			
Sizing Factor	1.00			
Fan Design Load CAV	6.1	W/m²	0.57	W/ft²
Fan Design Load VAV	6.1	W/m²	0.57	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	100%	0%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	75%	25%	50%	50%
Comments:				

EXHAUST FANS

Washroom Exhaust	50	L/s.washroom	106	CFM/washroom
Washroom Exhaust per gross unit are	0.0	L/s.m²	0.00	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.1	L/s.m²	0.02	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.2	W/m²	0.01	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.020	kW/kW	0.07	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	2.75	W/m²	0.26	W/ft²

Condenser Pump

Pump Design Flow	0.000	L/s.KW	0.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.000	L/s.m²	0.000	U.S. gpm/ft²
Pump Head Pressure	45	kPa	15	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.00	W/m²	0.00	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.006	L/s.m²	0.0087	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	0	kPa	0	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.0	W/m²	0.00	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	45.3	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	0.9	kWh/m².yr
Condenser Pump Energy Consumption	0.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	1.1	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	0.0	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI		
	kWh/ft².yr	4.4
	MJ/m².yr	170.2

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Medium Retail	**50,000 - 100,000 ft2**		**Inland South**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**22.6** kWh/ft².yr	**875.2** MJ/m².yr	**Fossil Fuel**	**6.5** kWh/ft².yr	**250.5** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	3.8	145.7
ARCHITECTURAL LIGHTING	4.9	189.8
SPECIAL PURPOSE LIGHTING	3.1	119.0
OTHER PLUG LOADS	0.5	20.1
HVAC FANS & PUMPS	4.4	170.2
REFRIGERATION	0.2	8.6
COMPUTER EQUIPMENT	1.2	46.9
ELEVATORS	0.3	11.6
OUTDOOR LIGHTING	1.3	50.9

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.3	12.1	5.6	215.4
SPACE COOLING	2.0	77.2	0.0	0.0
DOMESTIC HOT WATER	0.5	18.1	0.5	20.1
FOOD SERVICE EQUIPMENT	0.1	5.0	0.1	5.0
MISCELLANEOUS	0.0	0.0	0.3	10.0

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Food Retail	0		Inland South
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.64	W/m².°C	0.11	Btu/hr.ft² . °F
Roof U value (W/m².°C)	0.34	W/m².°C	0.06	Btu/hr.ft² . °F
Glazing U value (W/m².°C)	3.50	W/m².°C	0.62	Btu/hr.ft² . °F
Window/Wall Ratio (WIWAR) (%)	0.11			
Shading Coefficient (SC)	0.79			

Typical Building Size	4,000	m²	43,040	ft²
Typical Footprint (m²)	4,000	m²	43,040	ft²
Footprint Aspect Ratio (L:W)	1			
Percent Conditioned Space	100%			
Percent Conditioned Space Defined as Exterior Zone	40%			
Typical # Stories	1			
Floor to Floor Height (m)	7.0	m	23.0	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	100%		0%		0%		0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	45	m²/person	484	ft²/person
Occupancy Schedule Occ. Period	90%			
Occupancy Schedule Unocc. Period	0%			
Fresh Air Requirements or Outside Air	70	L/s.person	148	CFM/person

%OA 25.38%

Fresh Air Control Type *(enter a 1, 2 or 3) 1
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right:	0%			
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation	0.5	L/s.m²	0.10	CFM/ft²
	50%	operation (%)		

Sizing Factor	1.65			
Total Air Circulation or Design Air Flow	6.13	L/s.m²	1.21	CFM/ft²
Infiltration Rate	0.32	L/s.m²	0.06	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	1,917,359	
Peak Zone Sensible Load	676,613	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	31,476	
Total air circulation or Design air	6.13	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	22	°C	71.6	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	20.4	°C	68.72	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Food Retail	0		Inland South
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	600	Lux	55.8	ft-candles
Floor Fraction (GLFF)	0.40			
Connected Load	15.5	W/m²	1.4	W/ft²
Occ. Period(Hrs./yr.)	4100			
Unocc. Period(Hrs./yr.)	4660			
Usage During Occupied Period	100%			
Usage During Unoccupied Period	40%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	500	600	700	800				Total
% Distribution	25%	50%	25%	0%				100%
Weighted Average								**600**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)					100.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI		
	kWh/ft².yr	3.4
	MJ/m².yr	133

ARCHITECTURAL LIGHTING

Light Level	640	Lux	59.5	ft-candles
Floor Fraction (ALFF)	0.20			
Connected Load	47.8	W/m²	4.4	W/ft²
Occ. Period(Hrs./yr.)	4100			
Unocc. Period(Hrs./yr.)	4660			
Usage During Occupied Period	100%			
Usage During Unoccupied Period	50%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	300	500	700	1000				Total
% Distribution	0%	30%	70%	0%				100%
Weighted Average								**640**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	30%	70%						100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI		
	kWh/ft².yr	5.7
	MJ/m².yr	221

SPECIAL PURPOSE LIGHTING

Light Level	500.00	Lux	46.5	ft-candles
Floor Fraction (HBLFF)	0.40			
Connected Load	23.3	W/m²	2.2	W/ft²
Occ. Period(Hrs./yr.)	4100			
Unocc. Period(Hrs./yr.)	4660			
Usage During Occupied Period	100%			
Usage During Unoccupied Period	50%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 | 1.00

Light Level (Lux)	300	500	700	1000				Total
% Distribution	20%	60%	20%	0%				100%
Weighted Average								**500**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)						100%		100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI		
	kWh/ft².yr	5.6
	MJ/m².yr	216

TOTAL LIGHTING

Overall LPD	15.76 W/m²	EUI TOTAL	kWh/ft².yr	14.7
	1.47 W/ft²		MJ/m².yr	570

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Servers		Plug Loads	
Measured Power (W/device)	55		51		100		200		217			
Density (device/occupant)	0.648828		0.648828		0.01		0.01		0.03			
Connected Load	0.8	W/m²	0.7	W/m²	0.0	W/m²	0.0	W/m²	0.5	W/m²	2.85	W/m²
	0.1	W/ft²	0.1	W/ft²	0.00	W/ft²	0.00	W/ft²	0.05	W/ft²	0.26	W/ft²
Diversity Occupied Period	90%		90%		90%		90%		100%		90%	
Diversity Unoccupied Period	50%		50%		50%		50%		100%		50%	
Operation Occ. Period (hrs./year)	2000		2000		2600		2600		2600		4100	
Operation Unocc. Period (hrs./year)	6760		6760		6160		6160		6160		4660	

Total end-use load (occupied period)	4.5	W/m²	0.4	W/ft²
Total end-use load (unocc. period)	2.7	W/m²	0.3	W/ft²
Usage during occupied period	100%			
Usage during unoccupied period	61%			

Computer Equipment	EUI	kWh/ft².yr	1.18
		MJ/m².yr	45.81
Plug Loads	EUI	kWh/ft².yr	1.59
		MJ/m².yr	61.77

FOOD SERVICE EQUIPMENT

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	2.3	EUI	kWh/ft².yr	0.4
	MJ/m².yr	90.0		MJ/m².yr	15.0

REFRIGERATION

Provide description below:

Commercial refrigeration display cases

EUI		
	kWh/ft².yr	29.0
	MJ/m².yr	1125.0

MISCELLANEOUS

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	0.5	EUI	kWh/ft².yr	0.0
	MJ/m².yr	20.0		MJ/m².yr	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Food Retail	0		Inland South
Baseline			

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	3%	10%	2%	65%	10%	0%	4%	1%	5%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff. (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	24.0 W/m²	7.6 Btu/hr.ft²	
Seasonal Heating Load (Tertiary Load)	294 MJ/m².yr	7.6 kWh/ft².yr	
Sizing Factor	1.00		
Electric Fuel Share	10.0%	Fossil Fuel Share	90.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	5.8
MJ/m².yr	226

Gas EUI	
kWh/ft².yr	10.0
MJ/m².yr	386

Market Composite EUI	
kWh/ft².yr	9.5
MJ/m².yr	370

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	0.0%	0.0%	0.0%		100.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7 °C	44.6 °F
Condenser Water	30 °C	86 °F
Supply Air	14.0 °C	57.2 °F

Peak Cooling Load	140 W/m²	45 Btu/hr.ft²	269 ft²/Ton
Seasonal Cooling Load (Tertiary Load)	223.1 MJ/m².yr	5.8 kWh/ft².yr	

Sizing Factor 1.00 — Operation (occ. period) 3000 hrs/year Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C) 85.0%

Electric Fuel Share 100.0% — Gas Fuel Share 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	2.1
MJ/m².yr	79

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	2.1
MJ/m².yr	79

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	60%				5%
Eff./COP	0.65				0.75

	Fossil		Elec. Res.
Fuel Share	65%		35%
Blended Efficiency	0.66		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 65.0

Wetting Use Percentage 90%

All Electric EUI	
kWh/ft².yr	1.8
MJ/m².yr	71

Fossil Fuel EUI	
kWh/ft².yr	2.6
MJ/m².yr	99

Market Composite EUI	
kWh/ft².yr	2.3
MJ/m².yr	89.2

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Food Retail	0		Inland South
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	6.1	L/s.m²	1.21	CFM/ft²
System Static Pressure CAV	500	Pa	2.0	wg
System Static Pressure VAV	1000	Pa	4.0	wg
Fan Efficiency	60%			
Fan Motor Efficiency	80%			
Sizing Factor	1.00			
Fan Design Load CAV	6.4	W/m²	0.59	W/ft²
Fan Design Load VAV	12.8	W/m²	1.19	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	100%	0%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	40%	60%	100%	0%
Comments:				

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m²	0.01	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.2	L/s.m²	0.03	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.2	W/m²	0.02	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.027	kW/kW	0.09	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	3.79	W/m²	0.35	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.007	L/s.m²	0.011	U.S. gpm/ft²
Pump Head Pressure	0	kPa	0	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.00	W/m²	0.00	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.006	L/s.m²	0.0089	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	0	kPa	0	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.0	W/m²	0.00	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	35.8	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	1.8	kWh/m².yr
Condenser Pump Energy Consumption	0.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	1.3	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	0.0	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI	kWh/ft².yr	3.6
	MJ/m².yr	139.8

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Food Retail	0		Inland South
Baseline			

EUI SUMMARY

TOTAL ALL END-USES: **Electricity:** **54.7** kWh/ft².yr **2,118.5** MJ/m².yr **Fossil Fue** **13.5** kWh/ft².yr **521.2** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	3.4	133.1
ARCHITECTURAL LIGHTING	5.7	221.4
SPECIAL PURPOSE LIGHTING	5.6	215.8
OTHER PLUG LOADS	1.6	61.8
HVAC FANS & PUMPS	3.6	139.8
REFRIGERATION	29.0	1,125.0
COMPUTER EQUIPMENT	1.2	45.8
ELEVATORS	0.3	11.6
OUTDOOR LIGHTING	0.9	33.9

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.6	22.6	9.0	347.0
SPACE COOLING	1.7	67.5	0.0	0.0
DOMESTIC HOT WATER	0.6	25.0	1.7	64.2
FOOD SERVICE EQUIPMENT	0.4	15.0	2.3	90.0
MISCELLANEOUS	0.0	0.0	0.5	20.0

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **Large Hotel** **Baseline**
SIZE: **0**
VINTAGE:
REGION: **Inland South**

CONSTRUCTION

Wall U value (W/m².°C)	0.82	W/m².°C	0.14	Btu/hr.ft² . °F	Typical Building Size	20,000 m²	215,200	ft²
Roof U value (W/m².°C)	0.34	W/m².°C	0.06	Btu/hr.ft² . °F	Typical Footprint (m²)	2,000 m²	21,520	ft²
Glazing U value (W/m².°C)	3.50	W/m².°C	0.62	Btu/hr.ft² . °F	Footprint Aspect Ratio (L:W)	3		
					Percent Conditioned Space	100%		
					Percent Conditioned Space Defined as Exterior Zone	45%		
Window/Wall Ratio (WIWAR) (%)	0.30							
Shading Coefficient (SC)	0.65				Typical # Stories	10		
					Floor to Floor Height (m)	3.7 m	12.0	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	66%		0%		0%	34%	0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	60	m²/person	646	ft²/person
Occupancy Schedule Occ. Period	45%			
Occupancy Schedule Unocc. Period	80%			
Fresh Air Requirements or Outside Air	70	L/s.person	148	CFM/person

%OA 26.25%

Fresh Air Control Type *(enter a 1, 2 or 3) 1
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right: 15%
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation 0.5 L/s.m² 0.10 CFM/ft²
50% operation (%)

Sizing Factor	1.6			
Total Air Circulation or Design Air Flow	4.44	L/s.m²	0.88	CFM/ft²
Infiltration Rate	0.38	L/s.m²	0.07	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	7,144,719	
Peak Zone Sensible Load	2,530,169	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	117,703	
Total air circulation or Design air	4.44	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	23	°C	73.4	°F	15	°C	59	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	20.6	°C	69.08	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Hotel	0		Inland South
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	248	Lux	23.0	ft-candles
Floor Fraction (GLFF)	0.20			
Connected Load	6.4	W/m²	0.6	W/ft²

Occ. Period(Hrs./yr.)	3000
Unocc. Period(Hrs./yr.)	5760
Usage During Occupied Period	85%
Usage During Unoccupied Period	90%
Fixture Cleaning:	
Incidence of Practice	
Interval	years
Relamping Strategy & Incidence of Practice	Group / Spot

Light Level (Lux)	125	300	400	500			Total
% Distribution	30%	70%					100%
Weighted Average							**247.5**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			0.0%		100.0%			100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	0.9
	MJ/m².yr	36

ARCHITECTURAL LIGHTING

Light Level	220	Lux	20.4	ft-candles
Floor Fraction (ALFF)	0.80			
Connected Load	15.3	W/m²	1.4	W/ft²

Occ. Period(Hrs./yr.)	2500
Unocc. Period(Hrs./yr.)	6260
Usage During Occupied Period	60%
Usage During Unoccupied Period	40%
Fixture Cleaning:	
Incidence of Practice	
Interval	years
Relamping Strategy & Incidence of Practice	Group / Spot

Light Level (Lux)	100	200	300	400			Total
% Distribution	20%	50%	20%	10%			100%
Weighted Average							**220**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	25%	75%						100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI	kWh/ft².yr	4.6
	MJ/m².yr	177

EUI = Load X Hrs. X SF X GLFF

SPECIAL PURPOSE LIGHTING

Light Level	0.00	Lux	0.0	ft-candles
Floor Fraction (HBLFF)	0.00			
Connected Load	0.0	W/m²	0.0	W/ft²

Floor fraction check: should = 1.00 | 1.00

Occ. Period(Hrs./yr.)	4000
Unocc. Period(Hrs./yr.)	4760
Usage During Occupied Period	0%
Usage During Unoccupied Period	100%
Fixture Cleaning:	
Incidence of Practice	
Interval	years
Relamping Strategy & Incidence of Practice	Group / Spot

Light Level (Lux)	300	500	700	1000			Total
% Distribution		0%	0%	0%			0%
Weighted Average							**0**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)								0.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	0.0
	MJ/m².yr	0

TOTAL LIGHTING

Overall LPD	13.53 W/m²	EUI TOTAL	kWh/ft².yr	5.5
	1.26 W/ft²		MJ/m².yr	212

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Servers		Plug Loads	
Measured Power (W/device)	55		51		100		200		217			
Density (device/occupant)	0.3		0.3		0.05		0.033		0.03			
Connected Load	0.3	W/m²	0.3	W/m²	0.1	W/m²	0.1	W/m²	0.5	W/m²	2.2	W/m²
	0.0	W/ft²	0.0	W/ft²	0.01	W/ft²	0.01	W/ft²	0.05	W/ft²	0.20	W/ft²
Diversity Occupied Period	90%		90%		90%		90%		100%		70%	
Diversity Unoccupied Period	50%		50%		50%		50%		100%		25%	
Operation Occ. Period (hrs./year)	2500		2500		2500		2500		2500		3000	
Operation Unocc. Period (hrs./year)	6260		6260		6260		6260		6260		5760	

Total end-use load (occupied period)	2.7	W/m²	0.3	W/ft²
Total end-use load (unocc. period)	1.4	W/m²	0.1	W/ft²

Usage during occupied period	100%
Usage during unoccupied period	53%

Computer Equipment	EUI	kWh/ft².yr	0.78
		MJ/m².yr	30.14
Plug Loads	EUI	kWh/ft².yr	0.72
		MJ/m².yr	28.04

FOOD SERVICE EQUIPMENT

Provide description below:

Commercial food preparation

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	2.6	EUI	kWh/ft².yr	0.5
	MJ/m².yr	100.0		MJ/m².yr	17.5

REFRIGERATION

Provide description below:

Walk-in coolers/freezers, reach-in coolers/freezers, refrigerated buffet cases

EUI	kWh/ft².yr	0.6
	MJ/m².yr	25.0

MISCELLANEOUS

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	1.5	EUI	kWh/ft².yr	0.0
	MJ/m².yr	60.0		MJ/m².yr	0.0

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Hotel	0		Inland South
Baseline			

SPACE HEATING

Heating Plant Type

							Electric			Other	
				Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	5%	55%	10%	15%	0%	0%	5%	2%	8%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff.) (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	21.7	W/m²	6.9	Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	255	MJ/m².yr	6.6	kWh/ft².yr
Sizing Factor	1.00			
Electric Fuel Share	15.0%	Fossil Fuel Share	85.0%	

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	5.1
MJ/m².yr	197

Gas EUI	
kWh/ft².yr	8.2
MJ/m².yr	319

Market Composite EUI	
kWh/ft².yr	7.8
MJ/m².yr	301

SPACE COOLING

A/C Plant Type

			WSHP			Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	0.0%	33.3%	0.0%	33.3%	33.4%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7	°C	44.6	°F
Condenser Water	30	°C	86	°F
Supply Air	15.0	°C	59	°F

Peak Cooling Load	94	W/m²	30	Btu/hr.ft²	402	ft²/Ton
Seasonal Cooling Load (Tertiary Load)	171.2	MJ/m².yr	4.4	kWh/ft².yr		

Sizing Factor 0.90   Operation (occ. period) 3000 hrs/year   Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C) 80.0%

Electric Fuel Share 100.0%   Gas Fuel Share 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	1.7
MJ/m².yr	66

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	1.7
MJ/m².yr	66

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	20%				60%
Eff./COP	0.65				0.75

	Fossil		Elec. Res.
Fuel Share	80%		20%
Blended Efficiency	0.73		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 225.0

Wetting Use Percentage 90%

All Electric EUI	
kWh/ft².yr	6.4
MJ/m².yr	247

Fossil Fuel EUI	
kWh/ft².yr	8.0
MJ/m².yr	310

Market Composite EUI	
kWh/ft².yr	7.7
MJ/m².yr	297.7

EXISTING BUILDINGS: Large Hotel Baseline | **SIZE:** 0 | **VINTAGE:** | **REGION:** Inland South

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	4.4	L/s.m²	0.88	CFM/ft²
System Static Pressure CAV	500	Pa	2.0	wg
System Static Pressure VAV	750	Pa	3.0	wg
Fan Efficiency	60%			
Fan Motor Efficiency	70%			
Sizing Factor	1.00			
Fan Design Load CAV	5.3	W/m²	0.49	W/ft²
Fan Design Load VAV	7.9	W/m²	0.74	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	66%	0%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	75%	25%	100%	0%

Comments:

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m²	0.02	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.2	L/s.m²	0.04	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.3	W/m²	0.02	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.023	kW/kW	0.08	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	2.15	W/m²	0.20	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.005	L/s.m²	0.007	U.S. gpm/ft²
Pump Head Pressure	45	kPa	15	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.56	W/m²	0.05	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.004	L/s.m²	0.0060	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.8	W/m²	0.08	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	26.0	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	2.3	kWh/m².yr
Condenser Pump Energy Consumption	1.3	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	1.0	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	4.1	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI	kWh/ft².yr	3.2
	MJ/m².yr	124.9

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Large Hotel	**0**		**Inland South**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES: **Electricity:** **15.5** kWh/ft².yr **601.2** MJ/m².yr **Fossil Fue** **17.6** kWh/ft².yr **679.8** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	0.9	35.6
ARCHITECTURAL LIGHTING	4.6	176.6
SPECIAL PURPOSE LIGHTING	0.0	0.0
OTHER PLUG LOADS	0.7	28.0
HVAC FANS & PUMPS	3.2	124.9
REFRIGERATION	0.6	25.0
COMPUTER EQUIPMENT	0.8	30.1
ELEVATORS	0.3	11.6
OUTDOOR LIGHTING	0.5	20.4

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.8	29.6	7.0	271.6
SPACE COOLING	1.4	52.4	0.0	0.0
DOMESTIC HOT WATER	1.3	49.5	6.4	248.3
FOOD SERVICE EQUIPMENT	0.5	17.5	2.6	100.0
MISCELLANEOUS	0.0	0.0	1.5	60.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Hotel	50,000 to 100,000 ft^2		Inland South
Baseline			

CONSTRUCTION

Wall U value (W/m^2.°C)	0.78	W/m^2.°C	0.14	Btu/hr.ft^2 . °F
Roof U value (W/m^2.°C)	0.33	W/m^2.°C	0.06	Btu/hr.ft^2 . °F
Glazing U value (W/m^2.°C)	3.50	W/m^2.°C	0.62	Btu/hr.ft^2 . °F
Window/Wall Ratio (WIWAR) (%)	0.40			
Shading Coefficient (SC)	0.57			

Typical Building Size	6,000	m^2	64,560	ft^2
Typical Footprint (m^2)	1,500	m^2	16,140	ft^2
Footprint Aspect Ratio (L:W)	4			
Percent Conditioned Space	100%			
Percent Conditioned Space Defined as Exterior Zone	45%			
Typical # Stories	4			
Floor to Floor Height (m)	3.7	m	12.0	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	66%		0%		0%	34%	0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	50	m^2/person	538	ft^2/person
Occupancy Schedule Occ. Period	50%			
Occupancy Schedule Unocc. Period	80%			
Fresh Air Requirements or Outside Air	40	L/s.person	85	CFM/person

%OA 16.80%

Fresh Air Control Type *(enter a 1, 2 or 3) 1
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right:	15%			
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation	0.5	L/s.m^2	0.10	CFM/ft^2
	50%	operation (%)		

Sizing Factor	1.4			
Total Air Circulation or Design Air Flow	4.76	L/s.m^2	0.94	CFM/ft^2
Infiltration Rate	0.50	L/s.m^2	0.10	CFM/ft^2

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0	L/s.m^2	0.00	CFM/ft^2
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	1,886,450	
Peak Zone Sensible Load	929,740	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft^3/lbm
Design CFM	43,251	
Total air circulation or Design air	4.76	l/s.m^2

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	22	°C	71.6	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	21	°C	69.8	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning — Changes/Year:

Incidence of Annual Room Controls Maintenance:

Incidence of Annual HVAC Controls Maintenance:

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Hotel	50,000 to 100,000 ft²		Inland South
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	239	Lux	22.2	ft-candles
Floor Fraction (GLFF)	0.20			
Connected Load	6.2	W/m²	0.6	W/ft²

Occ. Period(Hrs./yr.)	3000
Unocc. Period(Hrs./yr.)	5760
Usage During Occupied Period	75%
Usage During Unoccupied Period	75%
Fixture Cleaning:	
Incidence of Practice	
Interval	years
Relamping Strategy & Incidence of Practice	Group / Spot

Light Level (Lux)	125	300	700	1000			Total
% Distribution	35%	65%	0%	0%			100%
Weighted Average							**238.75**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)					100.0%			100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	0.8
	MJ/m².yr	29

ARCHITECTURAL LIGHTING

Light Level	151	Lux	14.1	ft-candles
Floor Fraction (ALFF)	0.80			
Connected Load	11.8	W/m²	1.1	W/ft²

Occ. Period(Hrs./yr.)	2100
Unocc. Period(Hrs./yr.)	6660
Usage During Occupied Period	45%
Usage During Unoccupied Period	60%
Fixture Cleaning:	
Incidence of Practice	
Interval	years
Relamping Strategy & Incidence of Practice	Group / Spot

Light Level (Lux)	100	125	150	300			Total
% Distribution	0%	85%	0%	15%			100%
Weighted Average							**151.25**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	33%	67%						100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	4.3
	MJ/m².yr	167

SPECIAL PURPOSE LIGHTING

Light Level	0.00	Lux	0.0	ft-candles
Floor Fraction (HBLFF)	0.00			
Connected Load	0.0	W/m²	0.0	W/ft²

Floor fraction check: should = 1.00 | 1.00

Occ. Period(Hrs./yr.)	4000
Unocc. Period(Hrs./yr.)	4760
Usage During Occupied Period	0%
Usage During Unoccupied Period	100%
Fixture Cleaning:	
Incidence of Practice	
Interval	years
Relamping Strategy & Incidence of Practice	Group / Spot

Light Level (Lux)	300	500	700	1000			Total
% Distribution		0%	0%	0%			0%
Weighted Average							**0**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)								0.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	0.0
	MJ/m².yr	0

TOTAL LIGHTING	Overall LPD	10.65 W/m²	EUI TOTAL	kWh/ft².yr	5.1
		0.99 W/ft²		MJ/m².yr	197

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Servers		Plug Loads	
Measured Power (W/device)	55		51		100		200		217			
Density (device/occupant)	0.3		0.3		0.05		0.033		0.03			
Connected Load	0.3	W/m²	0.3	W/m²	0.1	W/m²	0.1	W/m²	0.5	W/m²	2.1	W/m²
	0.0	W/ft²	0.0	W/ft²	0.01	W/ft²	0.01	W/ft²	0.05	W/ft²	0.20	W/ft²
Diversity Occupied Period	90%		90%		90%		90%		100%		70%	
Diversity Unoccupied Period	50%		50%		50%		50%		100%		25%	
Operation Occ. Period (hrs./year)	2500		2500		2500		2500		2500		3000	
Operation Unocc. Period (hrs./year)	6260		6260		6260		6260		6260		5760	

Total end-use load (occupied period)	2.8	W/m²	0.3	W/ft²
Total end-use load (unocc. period)	1.5	W/m²	0.1	W/ft²
Usage during occupied period	100%			
Usage during unoccupied period	53%			

Computer Equipment	EUI	kWh/ft².yr	0.85
		MJ/m².yr	32.93
Plug Loads	EUI	kWh/ft².yr	0.69
		MJ/m².yr	26.76

FOOD SERVICE EQUIPMENT

Provide description below:

Kitchen services

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	1.5	EUI	kWh/ft².yr	1.0
	MJ/m².yr	60.0		MJ/m².yr	40.0

REFRIGERATION

Provide description below:

Walk-in coolers/freezers, reach-in coolers/freezers, refrigerated buffet cases

EUI	kWh/ft².yr	0.6
	MJ/m².yr	25.0

MISCELLANEOUS

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	1.5	EUI	kWh/ft².yr	0.0
	MJ/m².yr	60.0		MJ/m².yr	0.0

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: Medium Hotel Baseline | **SIZE:** 50,000 to 100,000 ft² | **VINTAGE:** | **REGION:** Inland South

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	5%	5%	5%	45%	0%	0%	2%	0%	38%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff. (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	32.7 W/m²	10.4 Btu/hr.ft²	
Seasonal Heating Load (Tertiary Load)	282 MJ/m².yr	7.3 kWh/ft².yr	
Sizing Factor	1.00		
Electric Fuel Share	40.0%	Fossil Fuel Share	60.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

EUI	kWh/ft².yr	MJ/m².yr
All Electric EUI	7.1	277
Gas EUI	9.5	369
Market Composite EUI	8.6	332

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	0.0%	0.0%	0.0%	25.0%	75.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7 °C	44.6 °F
Condenser Water	30 °C	86 °F
Supply Air	14.0 °C	57.2 °F

Peak Cooling Load	78 W/m²	25 Btu/hr.ft²	483 ft²/Ton
Seasonal Cooling Load (Tertiary Load)	177.3 MJ/m².yr	4.6 kWh/ft².yr	

Sizing Factor: 0.85 — Operation (occ. period): 3000 hrs/year — Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C): 60.0%

Electric Fuel Share: 100.0% — Gas Fuel Share: 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

EUI	kWh/ft².yr	MJ/m².yr
All Electric EUI	1.9	74
Natural Gas EUI	0.0	0
Market Composite EUI	1.9	74

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Std. Tank	PV Tank	Cond. Tnk	Std. Boiler	Cnd. Boil.
System Present (%)	40%				30%
Eff./COP	0.65				0.75

	Fossil	Elec. Res.
Fuel Share	70%	30%
Blended Efficiency	0.69	0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load): 225.0

Wetting Use Percentage: 90%

EUI	kWh/ft².yr	MJ/m².yr
All Electric EUI	6.4	247
Fossil Fuel EUI	8.4	325
Market Composite EUI	7.8	301.5

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Hotel	50,000 to 100,000 ft²		Inland South
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	4.8	L/s.m²	0.94	CFM/ft²
System Static Pressure CAV	250	Pa	1.0	wg
System Static Pressure VAV	250	Pa	1.0	wg
Fan Efficiency	45%			
Fan Motor Efficiency	70%			
Sizing Factor	1.00			
Fan Design Load CAV	3.8	W/m²	0.35	W/ft²
Fan Design Load VAV	3.8	W/m²	0.35	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	66%	0%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	80%	20%	100%	0%

Comments:

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m²	0.03	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.2	L/s.m²	0.05	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.3	W/m²	0.03	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.027	kW/kW	0.09	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	2.11	W/m²	0.20	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.004	L/s.m²	0.006	U.S. gpm/ft²
Pump Head Pressure	45	kPa	15	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.47	W/m²	0.04	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.003	L/s.m²	0.0050	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.7	W/m²	0.06	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	19.2	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	2.7	kWh/m².yr
Condenser Pump Energy Consumption	1.3	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	1.3	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	3.4	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI		
	kWh/ft².yr	2.6
	MJ/m².yr	100.6

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Hotel	50,000 to 100,000 ft²		Inland South
Baseline			

EUI SUMMARY

TOTAL ALL END-USES: **Electricity:** **17.5** kWh/ft².yr **679.6** MJ/m².yr **Fossil Fuel** **14.7** kWh/ft².yr **568.9** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	0.8	29.2
ARCHITECTURAL LIGHTING	4.3	167.5
SPECIAL PURPOSE LIGHTING	0.0	0.0
OTHER PLUG LOADS	0.7	26.8
HVAC FANS & PUMPS	2.6	100.6
REFRIGERATION	0.6	25.0
COMPUTER EQUIPMENT	0.9	32.9
ELEVATORS	0.3	11.6
OUTDOOR LIGHTING	0.4	17.0

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	2.9	110.6	5.7	221.6
SPACE COOLING	1.1	44.4	0.0	0.0
DOMESTIC HOT WATER	1.9	74.2	5.9	227.3
FOOD SERVICE EQUIPMENT	1.0	40.0	1.5	60.0
MISCELLANEOUS	0.0	0.0	1.5	60.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Hospital	**0**		**Inland South**
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.63	W/m².°C	0.11	Btu/hr.ft² . °F	Typical Building Size	14,000	m²	150,640	ft²
Roof U value (W/m².°C)	0.34	W/m².°C	0.06	Btu/hr.ft² . °F	Typical Footprint (m²)	1,400	m²	15,064	ft²
Glazing U value (W/m².°C)	3.50	W/m².°C	0.62	Btu/hr.ft² . °F	Footprint Aspect Ratio (L:W)	2			
					Percent Conditioned Space	100%			
					Percent Conditioned Space Defined as Exterior Zone	45%			
Window/Wall Ratio (WIWAR) (%)	0.20								
Shading Coefficient (SC)	0.66				Typical # Stories	8			
					Floor to Floor Height (m)	4.3	m	14.0	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	50%		0%		20%	30%	0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	30	m²/person	323	ft²/person	%OA	32.74%
Occupancy Schedule Occ. Period	90%					
Occupancy Schedule Unocc. Period	75%					
Fresh Air Requirements or Outside Air	57	L/s.person	121	CFM/person		

Fresh Air Control Type *(enter a 1, 2 or 3) | 1 | If Fresh Air Control Type = "2" enter % FA. to the right: | 15%
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air) | If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation | 0.5 L/s.m² | 0.10 CFM/ft²
50% operation (%)

Sizing Factor	2.3			
Total Air Circulation or Design Air Flow	5.80	L/s.m²	1.14	CFM/ft²

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Infiltration Rate	0.32	L/s.m²	0.06	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Economizer

	Enthalpy Based		Dry-Bulb Based	Total
Incidence of Use	0%		100%	100%
Switchover Point		KJ/kg.	18 °C	
		Btu/lbm	64.4 °F	

Summary of Design Parameters		
Peak Design Cooling Load	5,868,253	
Peak Zone Sensible Load	1,608,988	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	74,850	
Total air circulation or Design air	5.80	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	24	°C	75.2	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	22	°C	71.6	°F	16	°C	60.8	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	22	°C	71.6	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning — Changes/Year:

Incidence of Annual Room Controls Maintenance:

Incidence of Annual HVAC Controls Maintenance:

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Hospital	0		Inland South
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	475	Lux	44.1	ft-candles
Floor Fraction (GLFF)	0.95			
Connected Load	12.3	W/m²	1.1	W/ft²
Occ. Period(Hrs./yr.)	3100			
Unocc. Period(Hrs./yr.)	5660			
Usage During Occupied Period	80%			
Usage During Unoccupied Period	35%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	100	250	700	800				Total
% Distribution		50%	50%	0%				100%
Weighted Average								**475**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)					100.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	4.8
	MJ/m².yr	187

ARCHITECTURAL LIGHTING

Light Level	250	Lux	23.2	ft-candles
Floor Fraction (ALFF)	0.05			
Connected Load	21.2	W/m²	2.0	W/ft²
Occ. Period(Hrs./yr.)	4000			
Unocc. Period(Hrs./yr.)	4760			
Usage During Occupied Period	90%			
Usage During Unoccupied Period	75%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	200	300	500	700				Total
% Distribution	50%	50%	0%	0%				100%
Weighted Average								**250**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	40%	60%						100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	0.7
	MJ/m².yr	27

SPECIAL PURPOSE LIGHTING

Light Level	0.00	Lux	0.0	ft-candles
Floor Fraction (HBLFF)	0.00			
Connected Load	0.0	W/m²	0.0	W/ft²
Occ. Period(Hrs./yr.)	4000			
Unocc. Period(Hrs./yr.)	4760			
Usage During Occupied Period	0%			
Usage During Unoccupied Period	100%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 | 1.00

Light Level (Lux)	300	500	700	1000				Total
% Distribution		0%	0%	0%				0%
Weighted Average								**0**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)								0.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	0.0
	MJ/m².yr	0

TOTAL LIGHTING

Overall LPD	12.72 W/m²	EUI TOTAL	kWh/ft².yr	5.5
	1.18 W/ft²		MJ/m².yr	215

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Servers	Plug Loads
Measured Power (W/device)	55	51	100	200	217	
Density (device/occupant)	0.477744	0.477744	0.02	0.02	0.04	
Connected Load	0.9 W/m²	0.8 W/m²	0.1 W/m²	0.1 W/m²	0.5 W/m²	3.85 W/m²
	0.1 W/ft²	0.1 W/ft²	0.01 W/ft²	0.01 W/ft²	0.05 W/ft²	0.36 W/ft²
Diversity Occupied Period	90%	90%	90%	90%	100%	90%
Diversity Unoccupied Period	50%	50%	50%	50%	100%	25%
Operation Occ. Period (hrs./year)	2000	2000	2600	2600	2600	4100
Operation Unocc. Period (hrs./year)	6760	6760	6160	6160	6160	4660

Total end-use load (occupied period)	5.7 W/m²	0.5 W/ft²
Total end-use load (unocc. period)	2.4 W/m²	0.2 W/ft²
Usage during occupied period	100%	
Usage during unoccupied period	43%	

Computer Equipment	EUI	kWh/ft².yr	1.33
		MJ/m².yr	51.37
Plug Loads	EUI	kWh/ft².yr	1.74
		MJ/m².yr	67.29

FOOD SERVICE EQUIPMENT

Provide description below:

Commercial food services

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	1.8	EUI	kWh/ft².yr	0.1
	MJ/m².yr	70.0		MJ/m².yr	2.0

REFRIGERATION

Provide description below:

Walk-in coolers/freezers, reach-in coolers/freezers, refrigerated buffet cases

EUI	kWh/ft².yr	0.4
	MJ/m².yr	15.0

MISCELLANEOUS

Provide description below:

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	6.5	EUI	kWh/ft².yr	0.0
	MJ/m².yr	250.0		MJ/m².yr	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Hospital	0		Inland South
Baseline			

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	10%	75%	8%	5%	0%	0%	0%	0%	2%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff. (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	24.0	W/m²	7.6	Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	788	MJ/m².yr	20.3	kWh/ft².yr
Sizing Factor	1.00			
Electric Fuel Share	2.0%	Fossil Fuel Share	98.0%	

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	20.3
MJ/m².yr	788

Gas EUI	
kWh/ft².yr	25.5
MJ/m².yr	986

Market Composite EUI	
kWh/ft².yr	25.3
MJ/m².yr	982

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7	°C	44.6	°F
Condenser Water	30	°C	86	°F
Supply Air	14.0	°C	57.2	°F

Peak Cooling Load	80	W/m²	25	Btu/hr.ft²	474	ft²/Ton
Seasonal Cooling Load (Tertiary Load)	194.9	MJ/m².yr	5.0	kWh/ft².yr		

Sizing Factor: 0.65 — Operation (occ. period): 3000 hrs/year — Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C): 90.0%

Electric Fuel Share: 100.0% — Gas Fuel Share: 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenan

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	1.2
MJ/m².yr	48

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	1.2
MJ/m².yr	48

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	10%				80%
Eff./COP	0.65				0.80

	Fossil	Elec. Res.
Fuel Share	90%	10%
Blended Efficiency	0.78	0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load): 250.0

Wetting Use Percentage: 90%

All Electric EUI	
kWh/ft².yr	7.1
MJ/m².yr	275

Fossil Fuel EUI	
kWh/ft².yr	8.2
MJ/m².yr	319

Market Composite EUI	
kWh/ft².yr	8.1
MJ/m².yr	314.7

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Hospital	0		Inland South
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	5.8	L/s.m²	1.14	CFM/ft²
System Static Pressure CAV	1500	Pa	6.0	wg
System Static Pressure VAV	1100	Pa	4.4	wg
Fan Efficiency	55%			
Fan Motor Efficiency	89%			
Sizing Factor	1.00			
Fan Design Load CAV	17.8	W/m²	1.65	W/ft²
Fan Design Load VAV	13.0	W/m²	1.21	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	50%	20%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	50%	50%	100%	0%
Comments:				

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m²	0.03	CFM/ft²
Other Exhaust (Smoking/Conference)	0.5	L/s.m²	0.10	CFM/ft²
Total Building Exhaust	0.6	L/s.m²	0.13	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.9	W/m²	0.08	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.013	kW/kW	0.05	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	1.04	W/m²	0.10	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.004	L/s.m²	0.006	U.S. gpm/ft²
Pump Head Pressure	100	kPa	33.333333	ft
Pump Efficiency	60%			
Pump Motor Efficiency	88%			
Sizing Factor	1.0			
Pump Connected Load	0.80	W/m²	0.07	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.003	L/s.m²	0.0051	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	60%					
Pump Motor Efficiency	88%					
Sizing Factor	0.8					
Pump Connected Load	0.5	W/m²	0.05	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	64.5	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	7.5	kWh/m².yr
Condenser Pump Energy Consumption	2.3	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.6	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	2.6	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI		
	kWh/ft².yr	7.2
	MJ/m².yr	279.1

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Hospital	0		Inland South
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	Electricity:	19.6 kWh/ft².yr	759.9 MJ/m².yr	Fossil Fuel	40.6 kWh/ft².yr	1,573.4 MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	4.8	187.2
ARCHITECTURAL LIGHTING	0.7	27.4
SPECIAL PURPOSE LIGHTING	0.0	0.0
OTHER PLUG LOADS	1.7	67.3
HVAC FANS & PUMPS	7.2	279.1
REFRIGERATION	0.4	15.0
COMPUTER EQUIPMENT	1.3	51.4
ELEVATORS	0.3	11.6
OUTDOOR LIGHTING	0.8	32.2

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.4	15.8	24.9	966.2
SPACE COOLING	1.1	43.4	0.0	0.0
DOMESTIC HOT WATER	0.7	27.5	7.4	287.2
FOOD SERVICE EQUIPMENT	0.1	2.0	1.8	70.0
MISCELLANEOUS	0.0	0.0	6.5	250.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Nursing Home	50,000 to 100,000 ft²		Inland South
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.61	W/m².°C	0.11	Btu/hr.ft² . °F	Typical Building Size	8,364	m²	90,000	ft²
Roof U value (W/m².°C)	0.34	W/m².°C	0.06	Btu/hr.ft² . °F	Typical Footprint (m²)	4,182	m²	45,000	ft²
Glazing U value (W/m².°C)	3.50	W/m².°C	0.62	Btu/hr.ft² . °F	Footprint Aspect Ratio (L:W)	7			
					Percent Conditioned Space	100%			
					Percent Conditioned Space Defined as Exterior Zone	45%			
Window/Wall Ratio (WIWAR) (%)	0.28								
Shading Coefficient (SC)	0.60				Typical # Stories	2			
					Floor to Floor Height (m)	3.7	m	12.0	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	90%		0%		10%	0%	0%		100%
Min. Air Flow (%)					60%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	30	m²/person	323	ft²/person	%OA 29.17%
Occupancy Schedule Occ. Period	100%				
Occupancy Schedule Unocc. Period	95%				
Fresh Air Requirements or Outside Air	51	L/s.person	108	CFM/person	

Fresh Air Control Type *(enter a 1, 2 or 3) | 1 | If Fresh Air Control Type = "2" enter % FA. to the right: | 15%

(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air) | If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation | 0.5 L/s.m² | 0.10 CFM/ft² | 50% operation (%)

Sizing Factor	2			
Total Air Circulation or Design Air Flow	5.83	L/s.m²	1.15	CFM/ft²
Infiltration Rate (air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)	0.30	L/s.m²	0.06	CFM/ft²

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	3,970,024	
Peak Zone Sensible Load	1,110,131	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	51,643	
Total air circulation or Design air	5.83	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	23	°C	73.4	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	22	°C	71.6	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	22	°C	71.6	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning — Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Nursing Home	50,000 to 100,000 ft²		Inland South
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	267 Lux	24.8	ft-candles
Floor Fraction (GLFF)	0.70		
Connected Load	6.9 W/m²	0.6	W/ft²
Occ. Period(Hrs./yr.)	3400		
Unocc. Period(Hrs./yr.)	5360		
Usage During Occupied Period	95%		
Usage During Unoccupied Period	20%		
Fixture Cleaning:			
Incidence of Practice			
Interval	years		
Relamping Strategy & Incidence of Practice	Group	Spot	

Light Level (Lux)	200	300	500	1000			Total
% Distribution	33%	67%	0%	0%			100%
Weighted Average							**267**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)					100.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	1.9
	MJ/m².yr	75

ARCHITECTURAL LIGHTING

Light Level	233 Lux	21.7	ft-candles
Floor Fraction (ALFF)	0.30		
Connected Load	18.6 W/m²	1.7	W/ft²
Occ. Period(Hrs./yr.)	3400		
Unocc. Period(Hrs./yr.)	5360		
Usage During Occupied Period	95%		
Usage During Unoccupied Period	30%		
Fixture Cleaning:			
Incidence of Practice			
Interval	years		
Relamping Strategy & Incidence of Practice	Group	Spot	

Light Level (Lux)	200	300	400	500			Total
% Distribution	67%	33%	0%	0%			100%
Weighted Average							**233**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	35%	65%						100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	2.5
	MJ/m².yr	97

SPECIAL PURPOSE LIGHTING

Light Level	0.00 Lux	0.0	ft-candles
Floor Fraction (HBLFF)	0.00		
Connected Load	0.0 W/m²	0.0	W/ft²
Occ. Period(Hrs./yr.)	4000		
Unocc. Period(Hrs./yr.)	4760		
Usage During Occupied Period	0%		
Usage During Unoccupied Period	100%		
Fixture Cleaning:			
Incidence of Practice			
Interval	years		
Relamping Strategy & Incidence of Practice	Group	Spot	

Floor fraction check: should = 1.00 | 1.00

Light Level (Lux)	300	500	700	1000			Total
% Distribution		0%	0%	0%			0%
Weighted Average							**0**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)								0.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	0.0
	MJ/m².yr	0

TOTAL LIGHTING

Overall LPD	10.41 W/m²	EUI TOTAL	kWh/ft².yr	4.4
	0.97 W/ft²		MJ/m².yr	172

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Servers	Plug Loads
Measured Power (W/device)	55	51	100	200	217	
Density (device/occupant)	0.477744	0.477744	0.02	0.02	0.04	
Connected Load	0.9 W/m²	0.8 W/m²	0.1 W/m²	0.1 W/m²	0.5 W/m²	1.35 W/m²
	0.1 W/ft²	0.1 W/ft²	0.01 W/ft²	0.01 W/ft²	0.05 W/ft²	0.13 W/ft²
Diversity Occupied Period	90%	90%	90%	90%	100%	90%
Diversity Unoccupied Period	50%	50%	50%	50%	100%	25%
Operation Occ. Period (hrs./year)	2000	2000	2600	2600	2600	4100
Operation Unocc. Period (hrs./year)	6760	6760	6160	6160	6160	4660

Total end-use load (occupied period)	3.4 W/m²	0.3 W/ft²
Total end-use load (unocc. period)	1.8 W/m²	0.2 W/ft²
Usage during occupied period	100%	
Usage during unoccupied period	52%	

Computer Equipment	EUI	kWh/ft².yr	1.33
		MJ/m².yr	51.37
Plug Loads	EUI	kWh/ft².yr	0.61
		MJ/m².yr	23.60

FOOD SERVICE EQUIPMENT

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	1.5	EUI	kWh/ft².yr	1.3
	MJ/m².yr	60.0		MJ/m².yr	50.0

REFRIGERATION

Provide description below:

Walk-in coolers/freezers, reach-in coolers/freezers, refrigerated buffet cases

EUI	kWh/ft².yr	0.8
	MJ/m².yr	30.0

MISCELLANEOUS

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	1.8	EUI	kWh/ft².yr	0.0
	MJ/m².yr	70.0		MJ/m².yr	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Nursing Home	50,000 to 100,000 ft²		Inland South
Baseline			

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	10%	40%	10%	15%	15%	0%	5%	0%	5%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff. (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	22.2	W/m²	7.1	Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	352	MJ/m².yr	9.1	kWh/ft².yr
Sizing Factor	1.00			
Electric Fuel Share	10.0%	Fossil Fuel Share	90.0%	

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	7.2
MJ/m².yr	280
Gas EUI	
kWh/ft².yr	11.4
MJ/m².yr	443
Market Composite EUI	
kWh/ft².yr	11.0
MJ/m².yr	427

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	0.0%	0.0%	0.0%	15.0%	85.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7	°C	44.6	°F
Condenser Water	30	°C	86	°F
Supply Air	14.0	°C	57.2	°F

Peak Cooling Load	118	W/m²	37	Btu/hr.ft²	320	ft²/Ton
Seasonal Cooling Load (Tertiary Load)	173.8	MJ/m².yr	4.5	kWh/ft².yr		

Sizing Factor 0.85 — Operation (occ. period) 3000 hrs/year Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C) 30.0%

Electric Fuel Share 100.0% — Gas Fuel Share 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	1.9
MJ/m².yr	75
Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0
Market Composite EUI	
kWh/ft².yr	1.9
MJ/m².yr	75

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	25%				45%
Eff./COP	0.65				0.75

	Fossil	Elec. Res.
Fuel Share	70%	30%
Blended Efficiency	0.71	0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 170.0

Wetting Use Percentage 90%

All Electric EUI		Fossil Fuel EUI		Market Composite EUI	
kWh/ft².yr	4.8	kWh/ft².yr	6.1	kWh/ft².yr	5.7
MJ/m².yr	187	MJ/m².yr	238	MJ/m².yr	222.6

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Nursing Home	50,000 to 100,000 ft²		Inland South
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	5.8	L/s.m²	1.15	CFM/ft²
System Static Pressure CAV	500	Pa	2.0	wg
System Static Pressure VAV	500	Pa	2.0	wg
Fan Efficiency	52%			
Fan Motor Efficiency	75%			
Sizing Factor	1.00			
Fan Design Load CAV	7.5	W/m²	0.69	W/ft²
Fan Design Load VAV	7.5	W/m²	0.69	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	90%	10%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	80%	20%	100%	0%
Comments:				

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.0	L/s.m²	0.01	CFM/ft²
Other Exhaust (Smoking/Conference)	0.5	L/s.m²	0.10	CFM/ft²
Total Building Exhaust	0.5	L/s.m²	0.11	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.7	W/m²	0.07	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.020	kW/kW	0.07	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	2.36	W/m²	0.22	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.006	L/s.m²	0.009	U.S. gpm/ft²
Pump Head Pressure	0	kPa	0	ft
Pump Efficiency	55%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.00	W/m²	0.00	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.005	L/s.m²	0.0075	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	55%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.9	W/m²	0.09	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	55.8	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	6.4	kWh/m².yr
Condenser Pump Energy Consumption	0.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.9	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	4.6	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI		
	kWh/ft².yr	6.3
	MJ/m².yr	244.0

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Nursing Home	50,000 to 100,000 ft²		Inland South
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**18.3** kWh/ft².yr	**709.4** MJ/m².yr	**Fossil Fue**	**18.0** kWh/ft².yr	**695.4** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr	**END USE:**	Electricity kWh/ft².yr	Electricity MJ/m².yr	Fossil Fuel kWh/ft².yr	Fossil Fuel MJ/m².yr
GENERAL LIGHTING	1.9	74.8					
ARCHITECTURAL LIGHTING	2.5	97.2	SPACE HEATING	0.7	28.0	10.3	398.8
SPECIAL PURPOSE LIGHTING	0.0	0.0	SPACE COOLING	0.6	22.5	0.0	0.0
OTHER PLUG LOADS	0.6	23.6	DOMESTIC HOT WATER	1.4	56.0	4.3	166.6
HVAC FANS & PUMPS	6.3	244.0	FOOD SERVICE EQUIPMENT	1.3	50.0	1.5	60.0
REFRIGERATION	0.8	30.0	MISCELLANEOUS	0.0	0.0	1.8	70.0
COMPUTER EQUIPMENT	1.3	51.4					
ELEVATORS	0.3	11.6					
OUTDOOR LIGHTING	0.5	20.4					

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Large Schools	**> 50,000 ft2**		**Inland South**
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.57	W/m².°C	0.10	Btu/hr.ft² . °F
Roof U value (W/m².°C)	0.34	W/m².°C	0.06	Btu/hr.ft² . °F
Glazing U value (W/m².°C)	4.57	W/m².°C	0.80	Btu/hr.ft² . °F
Window/Wall Ratio (WIWAR) (%)	0.15			
Shading Coefficient (SC)	0.45			

Typical Building Size	9,300	m²	100,068	ft²
Typical Footprint (m²)	4,650	m²	50,034	ft²
Footprint Aspect Ratio (L:W)	5			
Percent Conditioned Space	100%			
Percent Conditioned Space Defined as Exterior Zone	37%			
Typical # Stories	2			
Floor to Floor Height (m)	4.0	m	13.2	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	80%		0%		20%		0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	10	m²/person	108	ft²/person
Occupancy Schedule Occ. Period	90%			
Occupancy Schedule Unocc. Period	0%			
Fresh Air Requirements or Outside Air	15	L/s.person	32	CFM/person

%OA 28.05%

Fresh Air Control Type *(enter a 1, 2 or 3) 1
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right: 34%
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation: 0.5 L/s.m² 0.10 CFM/ft²; 50% operation (%)

Sizing Factor	2			
Total Air Circulation or Design Air Flow	5.35	L/s.m²	1.05	CFM/ft²
Infiltration Rate	0.26	L/s.m²	0.05	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based	Total
Incidence of Use	0%		100%	100%
Switchover Point		KJ/kg.	18 °C	
		Btu/lbm	64.4 °F	

Summary of Design Parameters		
Peak Design Cooling Load	4,081,813	
Peak Zone Sensible Load	1,132,405	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	52,679	
Total air circulation or Design air	5.35	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

		Proportional	PI / PID	Total
Control Mode				0%
		Fixed Discharge	Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	23	°C	73.4	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	19.5	°C	67.1	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning — Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Schools	> 50,000 ft2		Inland South
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	450	Lux	41.8	ft-candles
Floor Fraction (GLFF)	0.89			
Connected Load	11.6	W/m²	1.1	W/ft²
Occ. Period(Hrs./yr.)	2500			
Unocc. Period(Hrs./yr.)	6260			
Usage During Occupied Period	85%			
Usage During Unoccupied Period	10%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	300	500	700	1000	Total
% Distribution	25%	75%	0%	0%	100%
Weighted Average					**450**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)					100.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	2.6
	MJ/m².yr	102

ARCHITECTURAL LIGHTING

Light Level	300	Lux	27.9	ft-candles
Floor Fraction (ALFF)	0.01			
Connected Load	19.3	W/m²	1.8	W/ft²
Occ. Period(Hrs./yr.)	3000			
Unocc. Period(Hrs./yr.)	5760			
Usage During Occupied Period	90%			
Usage During Unoccupied Period	75%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	300	500	700	1000	Total
% Distribution	100%	0%	0%	0%	100%
Weighted Average					**300**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	20%	80%						100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI	kWh/ft².yr	0.1
	MJ/m².yr	5

EUI = Load X Hrs. X SF X GLFF

SPECIAL PURPOSE LIGHTING

Light Level	300.00	Lux	27.9	ft-candles
Floor Fraction (HBLFF)	0.10			
Connected Load	14.0	W/m²	1.3	W/ft²
Occ. Period(Hrs./yr.)	3000			
Unocc. Period(Hrs./yr.)	5760			
Usage During Occupied Period	100%			
Usage During Unoccupied Period	0%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 — 1.00

Light Level (Lux)	300	500	700	1000	Total
% Distribution	100%	0%	0%	0%	100%
Weighted Average					**300**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)						100%		100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	0.4
	MJ/m².yr	15

TOTAL LIGHTING

Overall LPD	11.94 W/m²	EUI TOTAL	kWh/ft².yr	3.2
	1.11 W/ft²		MJ/m².yr	122

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Servers		Plug Loads	
Measured Power (W/device)	55		51		100		200		217			
Density (device/occupant)	0.222732		0.222732		0.02		0.02		0.01			
Connected Load	1.2	W/m²	1.1	W/m²	0.2	W/m²	0.4	W/m²	0.5	W/m²	0.1	W/m²
	0.1	W/ft²	0.1	W/ft²	0.02	W/ft²	0.04	W/ft²	0.05	W/ft²	0.01	W/ft²
Diversity Occupied Period	90%		90%		90%		90%		100%		100%	
Diversity Unoccupied Period	25%		25%		25%		25%		100%		0%	
Operation Occ. Period (hrs./year)	2000		2000		2000		2000		2600		3000	
Operation Unocc. Period (hrs./year)	6760		6760		6760		6760		6160		5760	

Total end-use load (occupied period)	3.3	W/m²	0.3	W/ft²
Total end-use load (unocc. period)	1.3	W/m²	0.1	W/ft²
Usage during occupied period	100%			
Usage during unoccupied period	38%			

	EUI		
Computer Equipment	EUI	kWh/ft².yr	1.37
		MJ/m².yr	53.21
Plug Loads	EUI	kWh/ft².yr	0.03
		MJ/m².yr	1.08

FOOD SERVICE EQUIPMENT

Provide description below:

Cafeteria

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	0.5	EUI	kWh/ft².yr	0.1
	MJ/m².yr	20.0		MJ/m².yr	2.1

REFRIGERATION

Provide description below:

Unknown

EUI	kWh/ft².yr	0.1
	MJ/m².yr	2.1

MISCELLANEOUS

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	0.1	EUI	kWh/ft².yr	0.0
	MJ/m².yr	5.0		MJ/m².yr	1.0

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Schools	> 50,000 ft2		Inland South
Baseline			

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	10%	60%	10%	5%	0%	0%	3%	10%	2%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff. (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	20.6	W/m²	6.5	Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	465	MJ/m².yr	12.0	kWh/ft².yr
Sizing Factor	1.00			
Electric Fuel Share	15.0%	Fossil Fuel Share	85.0%	

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	5.7
MJ/m².yr	220

Gas EUI	
kWh/ft².yr	15.0
MJ/m².yr	580

Market Composite EUI	
kWh/ft².yr	13.6
MJ/m².yr	526

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7	°C	44.6	°F
Condenser Water	30	°C	86	°F
Supply Air	14.0	°C	57.2	°F

Peak Cooling Load	129	W/m²	41	Btu/hr.ft²	294	ft²/Ton
Seasonal Cooling Load (Tertiary Load)	136.6	MJ/m².yr	3.5	kWh/ft².yr		

Sizing Factor 1.00 — Operation (occ. period) 3000 hrs/year — Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C) 20.0%

Electric Fuel Share 100.0% — Gas Fuel Share 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenan

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	1.4
MJ/m².yr	54

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	1.4
MJ/m².yr	54

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank					Boiler
System Present (%)	65%					25%
Eff./COP	0.65					0.75

	Fossil	Elec. Res.
Fuel Share	90%	10%
Blended Efficiency	0.68	0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 35.0

Wetting Use Percentage 90%

All Electric EUI	
kWh/ft².yr	1.0
MJ/m².yr	38

Fossil Fuel EUI	
kWh/ft².yr	1.3
MJ/m².yr	52

Market Composite EUI	
kWh/ft².yr	1.3
MJ/m².yr	50.3

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Schools	> 50,000 ft2		Inland South
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	5.3	L/s.m²	1.05	CFM/ft²
System Static Pressure CAV	500	Pa	2.0	wg
System Static Pressure VAV	500	Pa	2.0	wg
Fan Efficiency	60%			
Fan Motor Efficiency	88%			
Sizing Factor	1.00			
Fan Design Load CAV	5.1	W/m²	0.47	W/ft²
Fan Design Load VAV	5.1	W/m²	0.47	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	80%	20%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	50%	50%	50%	50%

Comments:

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.0	L/s.m²	0.01	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.1	L/s.m²	0.03	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.2	W/m²	0.02	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.027	kW/kW	0.09	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	3.47	W/m²	0.32	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.007	L/s.m²	0.010	U.S. gpm/ft²
Pump Head Pressure	45	kPa	15	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.77	W/m²	0.07	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.006	L/s.m²	0.0082	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	1.1	W/m²	0.10	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	28.7	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	1.2	kWh/m².yr
Condenser Pump Energy Consumption	1.6	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.9	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	5.5	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI		
	kWh/ft².yr	3.5
	MJ/m².yr	136.3

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large Schools	> 50,000 ft2		Inland South
Baseline			

EUI SUMMARY

TOTAL ALL END-USES: **Electricity:** **10.0** kWh/ft².yr **387.7** MJ/m².yr **Fossil Fue** **14.6** kWh/ft².yr **564.6** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	2.6	102.5
ARCHITECTURAL LIGHTING	0.1	4.9
SPECIAL PURPOSE LIGHTING	0.4	15.1
OTHER PLUG LOADS	0.0	1.1
HVAC FANS & PUMPS	3.5	136.3
REFRIGERATION	0.1	2.1
COMPUTER EQUIPMENT	1.4	53.2
ELEVATORS	0.3	11.6
OUTDOOR LIGHTING	0.3	10.2

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.9	33.0	12.7	493.1
SPACE COOLING	0.3	10.8	0.0	0.0
DOMESTIC HOT WATER	0.1	3.8	1.2	46.5
FOOD SERVICE EQUIPMENT	0.1	2.1	0.5	20.0
MISCELLANEOUS	0.0	1.0	0.1	5.0

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Schools	< 50,000 ft2		Inland South
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.57	W/m².°C	0.10	Btu/hr.ft² . °F
Roof U value (W/m².°C)	0.34	W/m².°C	0.06	Btu/hr.ft² . °F
Glazing U value (W/m².°C)	3.50	W/m².°C	0.62	Btu/hr.ft² . °F
Window/Wall Ratio (WIWAR) (%)	0.15			
Shading Coefficient (SC)	0.45			

Typical Building Size	2,300	m²	24,748	ft²
Typical Footprint (m²)	2,300	m²	24,748	ft²
Footprint Aspect Ratio (L:W)	5			
Percent Conditioned Space	100%			
Percent Conditioned Space Defined as Exterior Zone	50%			
Typical # Stories	1			
Floor to Floor Height (m)	4.0	m	13.2	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	90%		0%		10%		0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	10	m²/person	108	ft²/person
Occupancy Schedule Occ. Period	90%			
Occupancy Schedule Unocc. Period	0%			
Fresh Air Requirements or Outside Air	8	L/s.person	16	CFM/person

%OA 20.20%

Fresh Air Control Type *(enter a 1, 2 or 3) 1
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right: 34%
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation 0.5 L/s.m² 0.10 CFM/ft²
50% operation (%)

Sizing Factor	1.2			
Total Air Circulation or Design Air Flow	3.71	L/s.m²	0.73	CFM/ft²
Infiltration Rate	0.26	L/s.m²	0.05	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	715,285	
Peak Zone Sensible Load	324,181	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	15,081	
Total air circulation or Design air	3.71	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	21	°C	69.8	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	20.4	°C	68.72	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Schools	< 50,000 ft2		Inland South
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	400	Lux	37.2	ft-candles
Floor Fraction (GLFF)	0.89			
Connected Load	10.3	W/m²	1.0	W/ft²

Occ. Period(Hrs./yr.)	2400
Unocc. Period(Hrs./yr.)	6360
Usage During Occupied Period	85%
Usage During Unoccupied Period	25%

Light Level (Lux)	300	500	700	1000	Total
% Distribution	50%	50%	0%	0%	100%
Weighted Average					**400**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			0.0%		100.0%			100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

Fixture Cleaning:
Incidence of Practice
Interval years

Relamping Strategy & Incidence of Practice: Group | Spot

EUI	kWh/ft².yr	3.1
	MJ/m².yr	120

ARCHITECTURAL LIGHTING

Light Level	400	Lux	37.2	ft-candles
Floor Fraction (ALFF)	0.01			
Connected Load	25.8	W/m²	2.4	W/ft²

Occ. Period(Hrs./yr.)	2400
Unocc. Period(Hrs./yr.)	6360
Usage During Occupied Period	95%
Usage During Unoccupied Period	30%

Light Level (Lux)	300	500	700	1000	Total
% Distribution	50%	50%	0%	0%	100%
Weighted Average					**400**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	20%	80%						100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

Fixture Cleaning:
Incidence of Practice
Interval years

Relamping Strategy & Incidence of Practice: Group | Spot

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	0.1
	MJ/m².yr	4

SPECIAL PURPOSE LIGHTING

Light Level	300.00	Lux	27.9	ft-candles
Floor Fraction (HBLFF)	0.10			
Connected Load	14.0	W/m²	1.3	W/ft²

Floor fraction check: should = 1.00 | 1.00

Occ. Period(Hrs./yr.)	2500
Unocc. Period(Hrs./yr.)	6260
Usage During Occupied Period	100%
Usage During Unoccupied Period	0%

Light Level (Lux)	300	500	700	1000	Total
% Distribution	100%	0%	0%	0%	100%
Weighted Average					**300**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)						100%		100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

Fixture Cleaning:
Incidence of Practice
Interval years

Relamping Strategy & Incidence of Practice: Group | Spot

EUI	kWh/ft².yr	0.3
	MJ/m².yr	13

TOTAL LIGHTING	Overall LPD	9.45 W/m²	EUI TOTAL	kWh/ft².yr	3.5
		0.88 W/ft²		MJ/m².yr	137

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Servers		Plug Loads	
Measured Power (W/device)	55		51		100		200		217			
Density (device/occupant)	0.05		0.05		0.02		0.02		0.01			
Connected Load	0.3	W/m²	0.3	W/m²	0.2	W/m²	0.4	W/m²	0.5	W/m²	0.2	W/m²
	0.0	W/ft²	0.0	W/ft²	0.02	W/ft²	0.04	W/ft²	0.05	W/ft²	0.02	W/ft²
Diversity Occupied Period	90%		90%		90%		90%		100%		100%	
Diversity Unoccupied Period	25%		25%		25%		25%		100%		0%	
Operation Occ. Period (hrs./year)	2900		2900		2600		2600		2600		3000	
Operation Unocc. Period (hrs./year)	5860		5860		6160		6160		6160		5760	

Total end-use load (occupied period)	1.7	W/m²	0.2	W/ft²
Total end-use load (unocc. period)	0.8	W/m²	0.1	W/ft²

Usage during occupied period	100%
Usage during unoccupied period	46%

Computer Equipment	EUI	kWh/ft².yr	0.83
		MJ/m².yr	32.30
Plug Loads	EUI	kWh/ft².yr	0.06
		MJ/m².yr	2.16

FOOD SERVICE EQUIPMENT

Provide description below:
Cafeteria

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	0.1	EUI	kWh/ft².yr	0.1
	MJ/m².yr	5.0		MJ/m².yr	2.5

REFRIGERATION

Provide description below:
Unknown

EUI	kWh/ft².yr	0.1
	MJ/m².yr	3.0

MISCELLANEOUS

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	0.1	EUI	kWh/ft².yr	0.1
	MJ/m².yr	5.0		MJ/m².yr	5.0

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Schools	< 50,000 ft2		Inland South
Baseline			

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	10%	60%	14%	5%	0%	0%	0%	10%	1%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff. (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	28.5	W/m²	9.0	Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	252	MJ/m².yr	6.5	kWh/ft².yr
Sizing Factor	1.00			
Electric Fuel Share	11.0%	Fossil Fuel Share	89.0%	

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	2.6
MJ/m².yr	99

Gas EUI	
kWh/ft².yr	8.1
MJ/m².yr	313

Market Composite EUI	
kWh/ft².yr	7.5
MJ/m².yr	290

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7	°C	44.6	°F
Condenser Water	30	°C	86	°F
Supply Air	14.0	°C	57.2	°F

Peak Cooling Load	91	W/m²	29	Btu/hr.ft²	415	ft²/Ton
Seasonal Cooling Load (Tertiary Load)	125.6	MJ/m².yr	3.2	kWh/ft².yr		

Sizing Factor 1.00 — Operation (occ. period) 3000 hrs/year — Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C) 10.0%

Electric Fuel Share 100.0% — Gas Fuel Share 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	1.3
MJ/m².yr	50

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	1.3
MJ/m².yr	50

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	75%				10%
Eff./COP	0.65				0.75

	Fossil	Elec. Res.
Fuel Share	85%	15%
Blended Efficiency	0.66	0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 35.0

Wetting Use Percentage 90%

All Electric EUI	
kWh/ft².yr	1.0
MJ/m².yr	38

Fossil Fuel EUI	
kWh/ft².yr	1.4
MJ/m².yr	53

Market Composite EUI	
kWh/ft².yr	1.3
MJ/m².yr	50.7

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Schools	< 50,000 ft2		Inland South
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	3.7	L/s.m²	0.73	CFM/ft²
System Static Pressure CAV	250	Pa	1.0	wg
System Static Pressure VAV	250	Pa	1.0	wg
Fan Efficiency	60%			
Fan Motor Efficiency	88%			
Sizing Factor	1.00			
Fan Design Load CAV	1.8	W/m²	0.16	W/ft²
Fan Design Load VAV	1.8	W/m²	0.16	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	90%	10%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	50%	50%	50%	50%

Comments:

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m²	0.02	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.2	L/s.m²	0.04	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.2	W/m²	0.02	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.027	kW/kW	0.09	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	2.46	W/m²	0.23	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.005	L/s.m²	0.007	U.S. gpm/ft²
Pump Head Pressure	45	kPa	15	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.54	W/m²	0.05	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.004	L/s.m²	0.0058	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.8	W/m²	0.07	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	10.4	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	1.5	kWh/m².yr
Condenser Pump Energy Consumption	1.3	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.8	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	3.9	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI		
	kWh/ft².yr	1.7
	MJ/m².yr	64.5

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Schools	< 50,000 ft2		Inland South
Baseline			

EUI SUMMARY

TOTAL ALL END-USES: **Electricity:** **7.5** kWh/ft².yr **289.6** MJ/m².yr **Fossil Fue** **8.6** kWh/ft².yr **333.9** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	3.1	120.2
ARCHITECTURAL LIGHTING	0.1	3.9
SPECIAL PURPOSE LIGHTING	0.3	12.6
OTHER PLUG LOADS	0.1	2.2
HVAC FANS & PUMPS	1.7	64.5
REFRIGERATION	0.1	3.0
COMPUTER EQUIPMENT	0.8	32.3
ELEVATORS	0.3	11.6
OUTDOOR LIGHTING	0.3	10.2

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.3	10.9	7.2	278.9
SPACE COOLING	0.1	5.0	0.0	0.0
DOMESTIC HOT WATER	0.1	5.8	1.2	45.0
FOOD SERVICE EQUIPMENT	0.1	2.5	0.1	5.0
MISCELLANEOUS	0.1	5.0	0.1	5.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
University-Colleges	0		Inland South
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.68	W/m².°C	0.12	Btu/hr.ft² . °F	Typical Building Size	9,000 m²	96,840	ft²
Roof U value (W/m².°C)	0.34	W/m².°C	0.06	Btu/hr.ft² . °F	Typical Footprint (m²)	3,000 m²	32,280	ft²
Glazing U value (W/m².°C)	3.50	W/m².°C	0.62	Btu/hr.ft² . °F	Footprint Aspect Ratio (L:W)	7		
					Percent Conditioned Space	100%		
					Percent Conditioned Space Defined as Exterior Zone	50%		
Window/Wall Ratio (WIWAR) (%)	0.30							
Shading Coefficient (SC)	0.45				Typical # Stories	3		
					Floor to Floor Height (m)	3.7 m	12.0	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	50%		0%		50%		0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	14	m²/person	151	ft²/person	%OA	27.53%
Occupancy Schedule Occ. Period	90%					
Occupancy Schedule Unocc. Period	0%					
Fresh Air Requirements or Outside Air	20	L/s.person	42	CFM/person		

Fresh Air Control Type *(enter a 1, 2 or 3)	1	If Fresh Air Control Type = "2" enter % FA. to the right:	34%		
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)		If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation	0.5 L/s.m²	0.10	CFM/ft²
			50% operation (%)		

Sizing Factor	1.65			
Total Air Circulation or Design Air Flow	5.19	L/s.m²	1.02	CFM/ft²
Infiltration Rate	0.26	L/s.m²	0.05	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	3,958,400	
Peak Zone Sensible Load	1,289,230	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	59,975	
Total air circulation or Design air	5.19	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	24	°C	75.2	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	20.4	°C	68.72	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning — Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
University-Colleges	**0**		**Inland South**
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	480	Lux	44.6	ft-candles
Floor Fraction (GLFF)	0.93			
Connected Load	12.4	W/m²	1.2	W/ft²
Occ. Period(Hrs./yr.)	4100			
Unocc. Period(Hrs./yr.)	4660			
Usage During Occupied Period	90%			
Usage During Unoccupied Period	20%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	300	500	700	1000	Total
% Distribution	10%	90%	0%	0%	100%
Weighted Average					**480**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)					100.0%			100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	5.0
	MJ/m².yr	192

ARCHITECTURAL LIGHTING

Light Level	300	Lux	27.9	ft-candles
Floor Fraction (ALFF)	0.02			
Connected Load	20.9	W/m²	1.9	W/ft²
Occ. Period(Hrs./yr.)	4100			
Unocc. Period(Hrs./yr.)	4660			
Usage During Occupied Period	100%			
Usage During Unoccupied Period	100%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	300	500	700	1000	Total
% Distribution	100%	0%	0%	0%	100%
Weighted Average					**300**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	25%	75%						100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI	kWh/ft².yr	0.3
	MJ/m².yr	13

EUI = Load X Hrs. X SF X GLFF

SPECIAL PURPOSE LIGHTING

Light Level	500.00	Lux	46.5	ft-candles
Floor Fraction (HBLFF)	0.05			
Connected Load	18.9	W/m²	1.8	W/ft²
Occ. Period(Hrs./yr.)	4100			
Unocc. Period(Hrs./yr.)	4660			
Usage During Occupied Period	90%			
Usage During Unoccupied Period	20%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 | 1.00

Light Level (Lux)	300	500	700	1000	Total
% Distribution	0%	100%	0%	0%	100%
Weighted Average					**500**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)						100%		100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.7	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	0.4
	MJ/m².yr	16

TOTAL LIGHTING

Overall LPD	11.95 W/m²	EUI TOTAL	kWh/ft².yr	5.7
	1.11 W/ft²		MJ/m².yr	221

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Servers	Plug Loads
Measured Power (W/device)	55	51	100	200	217	
Density (device/occupant)	0.311825	0.311825	0.02	0.02	0.01	
Connected Load	1.2 W/m²	1.1 W/m²	0.1 W/m²	0.3 W/m²	0.5 W/m²	1.3 W/m²
	0.1 W/ft²	0.1 W/ft²	0.01 W/ft²	0.03 W/ft²	0.05 W/ft²	0.12 W/ft²
Diversity Occupied Period	90%	90%	90%	90%	100%	100%
Diversity Unoccupied Period	50%	50%	50%	50%	100%	20%
Operation Occ. Period (hrs./year)	2000	2000	2600	2600	2600	2000
Operation Unocc. Period (hrs./year)	6760	6760	6160	6160	6160	6760

Total end-use load (occupied period)	4.3 W/m²	0.4 W/ft²
Total end-use load (unocc. period)	2.2 W/m²	0.2 W/ft²
Usage during occupied period	100%	
Usage during unoccupied period	50%	

Computer Equipment	EUI	kWh/ft².yr	1.76
		MJ/m².yr	68.30
Plug Loads	EUI	kWh/ft².yr	0.40
		MJ/m².yr	15.69

FOOD SERVICE EQUIPMENT

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	0.8	EUI	kWh/ft².yr	0.3
	MJ/m².yr	30.0		MJ/m².yr	10.0

REFRIGERATION

Provide description below:

Unknown

EUI	kWh/ft².yr	0.5
	MJ/m².yr	20.0

MISCELLANEOUS

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	1.0	EUI	kWh/ft².yr	0.0
	MJ/m².yr	40.0		MJ/m².yr	0.0

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
University-Colleges	0		Inland South
Baseline			

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	10%	49%	25%	10%	0%	0%	2%	1%	2%	0%	99%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff. (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	26.5	W/m²	8.4	Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	348	MJ/m².yr	9.0	kWh/ft².yr
Sizing Factor	1.00			
Electric Fuel Share	5.0%	Fossil Fuel Share	95.0%	

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	6.3
MJ/m².yr	244

Gas EUI	
kWh/ft².yr	11.1
MJ/m².yr	428

Market Composite EUI	
kWh/ft².yr	10.7
MJ/m².yr	415

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	0.0%	25.0%	0.0%	0.0%	75.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7	°C	44.6	°F
Condenser Water	30	°C	86	°F
Supply Air	14.0	°C	57.2	°F

Peak Cooling Load	129	W/m²	41	Btu/hr.ft²	294	ft²/Ton
Seasonal Cooling Load (Tertiary Load)	175.3	MJ/m².yr	4.5	kWh/ft².yr		

Sizing Factor 1.00 — Operation (occ. period) 3000 hrs/year — Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C) 20.0%

Electric Fuel Share 100.0% — Gas Fuel Share 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	1.8
MJ/m².yr	69

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	1.8
MJ/m².yr	69

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	10%				80%
Eff./COP	0.65				0.75

	Fossil	Elec. Res.
Fuel Share	90%	10%
Blended Efficiency	0.74	0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 60.0

Wetting Use Percentage 90%

All Electric EUI	
kWh/ft².yr	1.7
MJ/m².yr	66

Fossil Fuel EUI	
kWh/ft².yr	2.1
MJ/m².yr	81

Market Composite EUI	
kWh/ft².yr	2.1
MJ/m².yr	79.7

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EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
University-Colleges	0		Inland South
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	5.2	L/s.m²	1.02	CFM/ft²
System Static Pressure CAV	950	Pa	3.8	wg
System Static Pressure VAV	950	Pa	3.8	wg
Fan Efficiency	60%			
Fan Motor Efficiency	80%			
Sizing Factor	1.00			
Fan Design Load CAV	10.3	W/m²	0.95	W/ft²
Fan Design Load VAV	10.3	W/m²	0.95	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	50%	50%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	50%	50%	100%	0%

Comments:

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m²	0.01	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.2	L/s.m²	0.03	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.2	W/m²	0.02	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.027	kW/kW	0.09	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	3.48	W/m²	0.32	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.007	L/s.m²	0.010	U.S. gpm/ft²
Pump Head Pressure	0	kPa	0	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.00	W/m²	0.00	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.006	L/s.m²	0.0082	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	1.1	W/m²	0.10	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	51.1	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	1.9	kWh/m².yr
Condenser Pump Energy Consumption	0.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	1.2	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	5.5	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI		
	kWh/ft².yr	5.6
	MJ/m².yr	215.2

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
University-Colleges	**0**		**Inland South**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES: **Electricity:** **15.8** kWh/ft².yr **611.1** MJ/m².yr **Fossil Fuel** **14.2** kWh/ft².yr **549.9** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	5.0	191.8
ARCHITECTURAL LIGHTING	0.3	13.2
SPECIAL PURPOSE LIGHTING	0.4	15.7
OTHER PLUG LOADS	0.4	15.7
HVAC FANS & PUMPS	5.6	215.2
REFRIGERATION	0.5	20.0
COMPUTER EQUIPMENT	1.8	68.3
ELEVATORS	0.3	11.6
OUTDOOR LIGHTING	0.4	17.0

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.3	12.2	10.5	406.8
SPACE COOLING	0.4	13.7	0.0	0.0
DOMESTIC HOT WATER	0.2	6.6	1.9	73.1
FOOD SERVICE EQUIPMENT	0.3	10.0	0.8	30.0
MISCELLANEOUS	0.0	0.0	1.0	40.0

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Restaurant	0		Inland South
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.62	W/m².°C	0.11	Btu/hr.ft² . °F	Typical Building Size	781	m²	8,400	ft²
Roof U value (W/m².°C)	0.32	W/m².°C	0.06	Btu/hr.ft² . °F	Typical Footprint (m²)	781	m²	8,400	ft²
Glazing U value (W/m².°C)	3.50	W/m².°C	0.62	Btu/hr.ft² . °F	Footprint Aspect Ratio (L:W)	1			
					Percent Conditioned Space	100%			
					Percent Conditioned Space Defined as Exterior Zone	45%			
Window/Wall Ratio (WIWAR) (%)	0.18								
Shading Coefficient (SC)	0.69				Typical # Stories	1			
					Floor to Floor Height (m)	3.8	m	12.5	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	100%		0%		0%		0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	20	m²/person	215	ft²/person	%OA	22.86%
Occupancy Schedule Occ. Period	90%					
Occupancy Schedule Unocc. Period	0%					
Fresh Air Requirements or Outside Air	30	L/s.person	64	CFM/person		

Fresh Air Control Type *(enter a 1, 2 or 3): 1
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right: 0%
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation: 0.5 L/s.m² — 0.10 CFM/ft²
50% operation (%)

Sizing Factor	1.5			
Total Air Circulation or Design Air Flow	6.56	L/s.m²	1.29	CFM/ft²
Infiltration Rate	0.70	L/s.m²	0.14	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	394,184	
Peak Zone Sensible Load	155,560	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R.	13.2	ft³/lbm
Design CFM	7,237	
Total air circulation or Design air	6.56	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	22	°C	71.6	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	21	°C	69.8	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning — Changes/Year:

Incidence of Annual Room Controls Maintenance:

Incidence of Annual HVAC Controls Maintenance:

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Restaurant	0		Inland South
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	400	Lux	37.1	ft-candles
Floor Fraction (GLFF)	0.30			
Connected Load	10.3	W/m²	1.0	W/ft²
Occ. Period(Hrs./yr.)	4100			
Unocc. Period(Hrs./yr.)	4660			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	30%			

Light Level (Lux)	300	400	500	1000	Total
% Distribution	33%	33%	33%	0%	100%
Weighted Average					**399.6**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)					100.0%			100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

Fixture Cleaning:		
Incidence of Practice		
Interval		years
Relamping Strategy & Incidence of Practice	Group	Spot

EUI	kWh/ft².yr	1.5
	MJ/m².yr	59

ARCHITECTURAL LIGHTING

Light Level	280	Lux	26.0	ft-candles
Floor Fraction (ALFF)	0.70			
Connected Load	29.5	W/m²	2.7	W/ft²
Occ. Period(Hrs./yr.)	4100			
Unocc. Period(Hrs./yr.)	4660			
Usage During Occupied Period	80%			
Usage During Unoccupied Period	30%			

Light Level (Lux)	100	200	300	400	Total
% Distribution	10%	30%	30%	30%	100%
Weighted Average					**280**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	60%	40%						100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

Fixture Cleaning:		
Incidence of Practice		
Interval		years
Relamping Strategy & Incidence of Practice	Group	Spot

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	9.0
	MJ/m².yr	348

SPECIAL PURPOSE LIGHTING

Light Level	0.00	Lux	0.0	ft-candles
Floor Fraction (HBLFF)	0.00			
Connected Load	0.0	W/m²	0.0	W/ft²
Occ. Period(Hrs./yr.)	4000			
Unocc. Period(Hrs./yr.)	4760			
Usage During Occupied Period	0%			
Usage During Unoccupied Period	100%			

Floor fraction check: should = 1.00 | 1.00

Light Level (Lux)	300	500	700	1000	Total
% Distribution		0%	0%	0%	0%
Weighted Average					**0**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)								0.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

Fixture Cleaning:		
Incidence of Practice		
Interval		years
Relamping Strategy & Incidence of Practice	Group	Spot

EUI	kWh/ft².yr	0.0
	MJ/m².yr	0

TOTAL LIGHTING

Overall LPD	23.77 W/m²	EUI TOTAL	kWh/ft².yr	10.5
	2.21 W/ft²		MJ/m².yr	407

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Servers		Plug Loads	
Measured Power (W/device)	55		51		100		200		217			
Density (device/occupant)	0.1614		0.1614		0.01		0.01		0.01			
Connected Load	0.4	W/m²	0.4	W/m²	0.1	W/m²	0.1	W/m²	0.5	W/m²	3.2	W/m²
	0.0	W/ft²	0.0	W/ft²	0.00	W/ft²	0.01	W/ft²	0.05	W/ft²	0.30	W/ft²
Diversity Occupied Period	90%		90%		90%		90%		100%		90%	
Diversity Unoccupied Period	50%		50%		50%		50%		100%		90%	
Operation Occ. Period (hrs./year)	2000		2000		2600		2600		2600		4100	
Operation Unocc. Period (hrs./year)	6760		6760		6160		6160		6160		4660	

Total end-use load (occupied period)	4.3	W/m²	0.4	W/ft²
Total end-use load (unocc. period)	3.9	W/m²	0.4	W/ft²
Usage during occupied period	100%			
Usage during unoccupied period	91%			

Computer Equipment	EUI	kWh/ft².yr	0.90
		MJ/m².yr	34.97
Plug Loads	EUI	kWh/ft².yr	2.34
		MJ/m².yr	90.82

FOOD SERVICE EQUIPMENT

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	23.2	EUI	kWh/ft².yr	8.6
	MJ/m².yr	900.0		MJ/m².yr	333.0

REFRIGERATION

Provide description below:

EUI	kWh/ft².yr	16.8
	MJ/m².yr	650.0

MISCELLANEOUS

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	0.8	EUI	kWh/ft².yr	2.3
	MJ/m².yr	30.0		MJ/m².yr	90.0

EXISTING BUILDINGS: Restaurant Baseline | **SIZE:** 0 | **VINTAGE:** | **REGION:** Inland South

SPACE HEATING

Heating Plant Type

							Electric			Other	
				Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	1%	2%	1%	59%	30%	0%	2%	0%	5%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff. (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	32.0	W/m²	10.2	Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	314	MJ/m².yr	8.1	kWh/ft².yr
Sizing Factor	1.00			

Electric Fuel Share 7.0% Fossil Fuel Share 93.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	7.2
MJ/m².yr	277

Gas EUI	
kWh/ft².yr	10.6
MJ/m².yr	410

Market Composite EUI	
kWh/ft².yr	10.3
MJ/m².yr	400

SPACE COOLING

A/C Plant Type

			WSHP			Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	0.0%	0.0%	0.0%	10.0%	90.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7	°C	44.6	°F
Condenser Water	30	°C	86	°F
Supply Air	14.0	°C	57.2	°F

Peak Cooling Load	178	W/m²	56	Btu/hr.ft²	213	ft²/Ton
Seasonal Cooling Load (Tertiary Load)	229.1	MJ/m².yr	5.9	kWh/ft².yr		

Sizing Factor 1.20 Operation (occ. period) 3000 hrs/year Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C) 70.0%

Electric Fuel Share 100.0% Gas Fuel Share 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenan

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	2.6
MJ/m².yr	101

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	2.6
MJ/m².yr	101

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Avg. Tank				Boiler
System Present (%)	65%				10%
Eff./COP	0.65				0.75

	Fossil	Elec. Res.
Fuel Share	75%	25%
Blended Efficiency	0.66	0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 600.0

Wetting Use Percentage 10%

All Electric EUI	
kWh/ft².yr	17.0
MJ/m².yr	659

Fossil Fuel EUI	
kWh/ft².yr	23.4
MJ/m².yr	905

Market Composite EUI	
kWh/ft².yr	21.8
MJ/m².yr	843.2

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Restaurant	**0**		**Inland South**
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	6.6	L/s.m²	1.29	CFM/ft²
System Static Pressure CAV	500	Pa	2.0	wg
System Static Pressure VAV	500	Pa	2.0	wg
Fan Efficiency	60%			
Fan Motor Efficiency	80%			
Sizing Factor	1.00			
Fan Design Load CAV	6.8	W/m²	0.64	W/ft²
Fan Design Load VAV	6.8	W/m²	0.64	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	100%	0%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	80%	20%	100%	0%

Comments:

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.3	L/s.m²	0.05	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.4	L/s.m²	0.07	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.5	W/m²	0.04	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.020	kW/kW	0.07	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	3.55	W/m²	0.33	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.009	L/s.m²	0.014	U.S. gpm/ft²
Pump Head Pressure	0	kPa	0	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.00	W/m²	0.00	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.008	L/s.m²	0.0113	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	0	kPa	0	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.0	W/m²	0.00	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	52.7	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	4.2	kWh/m².yr
Condenser Pump Energy Consumption	0.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	1.2	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	0.0	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI		
	kWh/ft².yr	5.4
	MJ/m².yr	209.0

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Restaurant	**0**		**Inland South**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES: **Electricity:** **57.5** kWh/ft².yr **2,227.4** MJ/m².yr **Fossil Fue** **51.4** kWh/ft².yr **1,989.3** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	1.5	59.0
ARCHITECTURAL LIGHTING	9.0	348.2
SPECIAL PURPOSE LIGHTING	0.0	0.0
OTHER PLUG LOADS	2.3	90.8
HVAC FANS & PUMPS	5.4	209.0
REFRIGERATION	16.8	650.0
COMPUTER EQUIPMENT	0.9	35.0
ELEVATORS	0.3	11.6
OUTDOOR LIGHTING	3.8	145.9

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.5	19.4	9.8	380.9
SPACE COOLING	1.8	70.6	0.0	0.0
DOMESTIC HOT WATER	4.3	164.8	17.5	678.4
FOOD SERVICE EQUIPMENT	8.6	333.0	23.2	900.0
MISCELLANEOUS	2.3	90.0	0.8	30.0

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Warehouse/Whsale	**0**		**Inland South**
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.45	W/m².°C	0.08	Btu/hr.ft².°F	Typical Building Size	3,200	m²	34,432	ft²
Roof U value (W/m².°C)	0.32	W/m².°C	0.06	Btu/hr.ft².°F	Typical Footprint (m²)	3,200	m²	34,432	ft²
Glazing U value (W/m².°C)	3.50	W/m².°C	0.62	Btu/hr.ft².°F	Footprint Aspect Ratio (L:W)	1			
					Percent Conditioned Space	100%			
					Percent Conditioned Space Defined as Exterior Zone	40%			
Window/Wall Ratio (WIWAR) (%)	0.05								
Shading Coefficient (SC)	0.80				Typical # Stories	1			
					Floor to Floor Height (m)	6.1	m	19.9	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	100%		0%		0%		0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	100	m²/person	1076	ft²/person	%OA	14.00%
Occupancy Schedule Occ. Period	90%					
Occupancy Schedule Unocc. Period	0%					
Fresh Air Requirements or Outside Air	30	L/s.person	64	CFM/person		

Fresh Air Control Type *(enter a 1, 2 or 3): 1
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right:	0%			
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation	0.5	L/s.m²	0.10	CFM/ft²
	50%	operation (%)		

Sizing Factor	1			
Total Air Circulation or Design Air Flow	2.14	L/s.m²	0.42	CFM/ft²
Infiltration Rate	0.38	L/s.m²	0.07	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)	0	L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	507,921	
Peak Zone Sensible Load	312,295	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	14,528	
Total air circulation or Design air	2.14	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	22	°C	71.6	°F	13	°C	55.4	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	16	°C	60.8	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	20.25	°C	68.45	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning — Changes/Year:

Incidence of Annual Room Controls Maintenance:

Incidence of Annual HVAC Controls Maintenance:

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Warehouse/Whsale	0		Inland South
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	400	Lux	37.2	ft-candles
Floor Fraction (GLFF)	0.18			
Connected Load	10.3	W/m²	1.0	W/ft²
Occ. Period(Hrs./yr.)	3500			
Unocc. Period(Hrs./yr.)	5260			
Usage During Occupied Period	100%			
Usage During Unoccupied Period	25%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	300	500	700	1000	Total
% Distribution	50%	50%	0%	0%	100%
Weighted Average					**400**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			0.0%	0%	100.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	0.8
	MJ/m².yr	32

ARCHITECTURAL LIGHTING

Light Level	300	Lux	27.9	ft-candles
Floor Fraction (ALFF)	0.01			
Connected Load	23.3	W/m²	2.2	W/ft²
Occ. Period(Hrs./yr.)	2500			
Unocc. Period(Hrs./yr.)	6260			
Usage During Occupied Period	100%			
Usage During Unoccupied Period	50%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	300	500	700	1000	Total
% Distribution	100%	0%	0%	0%	100%
Weighted Average					**300**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	33%	67%					0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	0.1
	MJ/m².yr	5

SPECIAL PURPOSE LIGHTING

Light Level	400.00	Lux	37.2	ft-candles
Floor Fraction (HBLFF)	0.81			
Connected Load	15.6	W/m²	1.5	W/ft²
Occ. Period(Hrs./yr.)	3500			
Unocc. Period(Hrs./yr.)	5260			
Usage During Occupied Period	100%			
Usage During Unoccupied Period	25%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 — 1.00

Light Level (Lux)	300	500	700	1000	Total
% Distribution	50%	50%	0%	0%	100%
Weighted Average					**400**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)						85%	15%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.7	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	5.7
	MJ/m².yr	219

TOTAL LIGHTING

Overall LPD	14.73 W/m²	EUI TOTAL	kWh/ft².yr	6.6
	1.37 W/ft²		MJ/m².yr	256

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Servers		Plug Loads	
Measured Power (W/device)	55		51		100		200		217			
Density (device/occupant)	0.5918		0.5918		0.03		0.03		0.06			
Connected Load	0.3	W/m²	0.3	W/m²	0.0	W/m²	0.1	W/m²	0.5	W/m²	2.5	W/m²
	0.0	W/ft²	0.0	W/ft²	0.00	W/ft²	0.01	W/ft²	0.05	W/ft²	0.23	W/ft²
Diversity Occupied Period	90%		90%		90%		90%		100%		90%	
Diversity Unoccupied Period	50%		50%		50%		50%		100%		25%	
Operation Occ. Period (hrs./year)	2000		2000		2600		2600		2600		4100	
Operation Unocc. Period (hrs./year)	6760		6760		6160		6160		6160		4660	

Total end-use load (occupied period)	3.4	W/m²	0.3	W/ft²
Total end-use load (unocc. period)	1.5	W/m²	0.1	W/ft²
Usage during occupied period	100%			
Usage during unoccupied period	44%			

	EUI		
Computer Equipment	EUI	kWh/ft².yr	0.76
		MJ/m².yr	29.58
Plug Loads	EUI	kWh/ft².yr	1.13
		MJ/m².yr	43.70

FOOD SERVICE EQUIPMENT

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	0.1	EUI	kWh/ft².yr	0.1
	MJ/m².yr	5.0		MJ/m².yr	5.0

REFRIGERATION

Provide description below:

Large refrigeration storage

EUI	kWh/ft².yr	1.3
	MJ/m².yr	50.0

MISCELLANEOUS

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	0.3	EUI	kWh/ft².yr	0.5
	MJ/m².yr	10.0		MJ/m².yr	20.0

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Warehouse/Whsale	**0**		**Inland South**
Baseline			

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						Gas	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Radiant	
System Present (%)	2%	5%	1%	35%	7%	30%		2%	3%	15%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	75%	1.70	3.00	100%	75%	
Performance (1 / Eff. (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.33	0.59	0.33	1.00	1.33	

Peak Heating Load	26.7	W/m²	8.5	Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	199	MJ/m².yr	5.1	kWh/ft².yr
Sizing Factor	1.00			
Electric Fuel Share	5.0%	Fossil Fuel Share	95.0%	

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	3.8
MJ/m².yr	146

Gas EUI	
kWh/ft².yr	6.8
MJ/m².yr	262

Market Composite EUI	
kWh/ft².yr	6.6
MJ/m².yr	257

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	0.0%	0.0%	0.0%	10.0%	90.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7	°C	44.6	°F
Condenser Water	30	°C	86	°F
Supply Air	13.0	°C	55.4	°F

Peak Cooling Load	47	W/m²	15	Btu/hr.ft²	813	ft²/Ton
Seasonal Cooling Load (Tertiary Load)	99.4	MJ/m².yr	2.6	kWh/ft².yr		

Sizing Factor 1.00 Operation (occ. period) 3000 hrs/year Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C) 30.0%

Electric Fuel Share 100.0% Gas Fuel Share 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenan

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	0.5
MJ/m².yr	21

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	0.5
MJ/m².yr	21

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	65%				5%
Eff./COP	0.65				0.75

	Fossil		Elec. Res.
Fuel Share	70%		30%
Blended Efficiency	0.66		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 22.5

Wetting Use Percentage 90%

All Electric EUI	
kWh/ft².yr	0.6
MJ/m².yr	25

Fossil Fuel EUI	
kWh/ft².yr	0.9
MJ/m².yr	34

Market Composite EUI	
kWh/ft².yr	0.8
MJ/m².yr	31.4

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EXISTING BUILDINGS: Warehouse/Whsale Baseline | **SIZE:** 0 | **VINTAGE:** | **REGION:** Inland South

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	2.1	L/s.m²	0.42	CFM/ft²
System Static Pressure CAV	425	Pa	1.7	wg
System Static Pressure VAV	425	Pa	1.7	wg
Fan Efficiency	60%			
Fan Motor Efficiency	80%			
Sizing Factor	1.00			
Fan Design Load CAV	1.9	W/m²	0.18	W/ft²
Fan Design Load VAV	1.9	W/m²	0.18	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	100%	0%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	0%	100%	100%	0%

Comments:

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m²	0.01	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.2	L/s.m²	0.03	CFM/ft²
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.2	W/m²	0.02	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.020	kW/kW	0.07	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	0.93	W/m²	0.09	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.002	L/s.m²	0.004	U.S. gpm/ft²
Pump Head Pressure	0	kPa	0	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.00	W/m²	0.00	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.002	L/s.m²	0.0030	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	50	kPa	17	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.2	W/m²	0.02	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	6.6	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	1.9	kWh/m².yr
Condenser Pump Energy Consumption	0.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.3	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	0.9	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI		
	kWh/ft².yr	0.9
	MJ/m².yr	34.7

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Warehouse/Whsale	**0**		**Inland South**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES: **Electricity:** **12.6** kWh/ft².yr **488.7** MJ/m².yr **Fossil Fue** **7.4** kWh/ft².yr **288.3** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	0.8	32.2
ARCHITECTURAL LIGHTING	0.1	4.7
SPECIAL PURPOSE LIGHTING	5.7	219.1
OTHER PLUG LOADS	1.1	43.7
HVAC FANS & PUMPS	0.9	34.7
REFRIGERATION	1.3	50.0
COMPUTER EQUIPMENT	0.8	29.6
ELEVATORS	0.3	11.6
OUTDOOR LIGHTING	0.4	17.0

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.2	7.3	6.4	249.3
SPACE COOLING	0.2	6.2	0.0	0.0
DOMESTIC HOT WATER	0.2	7.4	0.6	24.0
FOOD SERVICE EQUIPMENT	0.1	5.0	0.1	5.0
MISCELLANEOUS	0.5	20.0	0.3	10.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: Large High Rise Baseline
SIZE: > 9,300 m² (100,000 ft²)
VINTAGE:
REGION: Inland South

CONSTRUCTION

Wall U value (W/m².°C)	0.81	W/m².°C	0.14	Btu/hr.ft² . °F
Roof U value (W/m².°C)	0.34	W/m².°C	0.06	Btu/hr.ft² . °F
Glazing U value (W/m².°C)	3.50	W/m².°C	0.62	Btu/hr.ft² . °F
Window/Wall Ratio (WIWAR) (%)	0.25			
Shading Coefficient (SC)	0.65			

Typical Building Size	21,365	m²	229,887	ft²
Typical Footprint (m²)	1,125	m²	12,100	ft²
Footprint Aspect Ratio (L:W)	1			
Percent Conditioned Space	100%			
Percent Conditioned Space Defined as Exterior Zone	45%			
Typical # Stories	19			
Floor to Floor Height (m)	3.7	m	12.0	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	100%		0%		0%		0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	40	m²/person	430	ft²/person
Occupancy Schedule Occ. Period	25%			
Occupancy Schedule Unocc. Period	80%			
Fresh Air Requirements or Outside Air	10	L/s.person	21	CFM/person

%OA 100.00%

Fresh Air Control Type *(enter a 1, 2 or 3) 3
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right: 0%
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation 0.25 L/s.m² 0.05 CFM/ft²
75% operation (%)

Sizing Factor	1			
Total Air Circulation or Design Air Flow	0.25	L/s.m²	0.05	CFM/ft²
Infiltration Rate	0.05	L/s.m²	0.01	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA) L/s.m² 0.00 CFM/ft²
Operation occupied period 50%
Operation unoccupied period 50%

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	3,458,744	
Peak Zone Sensible Load	2,377,067	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	110,581	
Total air circulation or Design air	2.44	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	20	°C	68	°F	13	°C	55.4	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	20.4	°C	68.72	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large High Rise	> 9,300 m² (100,000 ft²)		Inland South
Baseline			

LIGHTING

GENERAL (Linear Fluorescent) LIGHTING

Light Level	160	Lux	14.9	ft-candles
Floor Fraction (GLFF)	0.10			
Connected Load	4.1	W/m²	0.4	W/ft²
Occ. Period(Hrs./yr.)	3400			
Unocc. Period(Hrs./yr.)	5360			
Usage During Occupied Period	90%			
Usage During Unoccupied Period	90%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	50	100	200	300	Total
% Distribution	0%	60%	20%	20%	100%
Weighted Average					**160**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			0.0%	0%	100.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	0.3
	MJ/m².yr	12

ARCHITECTURAL (Incandescent & replacements) LIGHTING

Light Level	130	Lux	12.1	ft-candles
Floor Fraction (ALFF)	0.90			
Connected Load	9.7	W/m²	0.9	W/ft²
Occ. Period(Hrs./yr.)	2900			
Unocc. Period(Hrs./yr.)	5860			
Usage During Occupied Period	25%			
Usage During Unoccupied Period	20%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	50	200	300	500	Total
% Distribution	60%	20%	20%	0%	100%
Weighted Average					**130**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	30%	70%					0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI	kWh/ft².yr	1.5
	MJ/m².yr	60

EUI = Load X Hrs. X SF X GLFF

SPECIAL PURPOSE LIGHTING

Light Level	0.00	Lux	0.0	ft-candles
Floor Fraction (HBLFF)	0.00			
Connected Load	0.0	W/m²	0.0	W/ft²
Occ. Period(Hrs./yr.)	4000			
Unocc. Period(Hrs./yr.)	4760			
Usage During Occupied Period	0%			
Usage During Unoccupied Period	100%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 | 1.00

Light Level (Lux)	300	500	700	1000	Total
% Distribution		0%	0%	0%	0%
Weighted Average					**0**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)								0.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	0.0
	MJ/m².yr	0

TOTAL LIGHTING

Overall LPD	9.16 W/m²	EUI TOTAL	kWh/ft².yr	1.8
	0.85 W/ft²		MJ/m².yr	71

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Servers		Plug Loads	
Measured Power (W/device)	45		57		100		200		50			
Density (device/occupant)	0.8		0.8		0		0		0.00			
Connected Load	0.9	W/m²	1.1	W/m²	0.0	W/m²	0.0	W/m²	0.5	W/m²	1.8	W/m²
	0.1	W/ft²	0.1	W/ft²	0.00	W/ft²	0.00	W/ft²	0.05	W/ft²	0.17	W/ft²
Diversity Occupied Period	0%		0%		90%		90%		100%		40%	
Diversity Unoccupied Period	50%		50%		50%		10%		100%		85%	
Operation Occ. Period (hrs./year)	2900		2900		2600		2600		2600		3000	
Operation Unocc. Period (hrs./year)	5860		5860		6160		6160		6160		5760	

Total end-use load (occupied period)	1.2	W/m²	0.1	W/ft²
Total end-use load (unocc. period)	3.1	W/m²	0.3	W/ft²
Usage during occupied period	100%			
Usage during unoccupied period	249%			

Computer Equipment	EUI	kWh/ft².yr	0.98
		MJ/m².yr	37.77
Plug Loads	EUI	kWh/ft².yr	1.02
		MJ/m².yr	39.50

FOOD SERVICE EQUIPMENT

Provide description below:

Electric stoves (at 417 kWh/yr), etc.

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	0.3	EUI	kWh/ft².yr	0.7
	MJ/m².yr	10.0		MJ/m².yr	27.0

REFRIGERATION

Provide description below:

Residential refrigerators (560 kWh/yr) and freezers (370 kWh/yr)

EUI	kWh/ft².yr	0.7
	MJ/m².yr	26.0

MISCELLANEOUS

Provide description below:

	Gas EUI			Electric EUI	
EUI	kWh/ft².yr	1.0	EUI	kWh/ft².yr	0.4
	MJ/m².yr	40.0		MJ/m².yr	15.0

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COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large High Rise	> 9,300 m² (100,000 ft²)		Inland South
Baseline			

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	5%	30%	10%	25%	15%	0%	3%	3%	9%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff. (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	20.0	W/m²	6.3	Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	270	MJ/m².yr	7.0	kWh/ft².yr
Sizing Factor	1.00			

Electric Fuel Share 15.0% Fossil Fuel Share 85.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	5.5
MJ/m².yr	212

Gas EUI	
kWh/ft².yr	8.8
MJ/m².yr	341

Market Composite EUI	
kWh/ft².yr	8.3
MJ/m².yr	321

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	1.0%	0.0%		5.0%	94.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7	°C	44.6	°F
Condenser Water	30	°C	86	°F
Supply Air	13.0	°C	55.4	°F

Peak Cooling Load	7	W/m²	2	Btu/hr.ft²	5317	ft²/Ton
Seasonal Cooling Load (Tertiary Load)	101.4	MJ/m².yr	2.6	kWh/ft².yr		

Sizing Factor 0.15 Operation (occ. period) 3000 hrs/year Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C) 15.0%

Electric Fuel Share 100.0% Gas Fuel Share 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenan

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	0.7
MJ/m².yr	26

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	0.7
MJ/m².yr	26

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	25%				50%
Eff./COP	0.65				0.75

	Fossil		Elec. Res.
Fuel Share	75%		25%
Blended Efficiency	0.72		1.00

Service Hot Water load (MJ/m².yr) (Tertiary Load) 200.0

Wetting Use Percentage 80%

All Electric EUI	
kWh/ft².yr	5.2
MJ/m².yr	200

Fossil Fuel EUI	
kWh/ft².yr	7.2
MJ/m².yr	279

Market Composite EUI	
kWh/ft².yr	6.7
MJ/m².yr	259.3

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EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large High Rise	> 9,300 m² (100,000 ft²)		Inland South
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	0.3	L/s.m²	0.05	CFM/ft²
System Static Pressure CAV	625	Pa	2.5	wg
System Static Pressure VAV	0	Pa	0.0	wg
Fan Efficiency	52%			
Fan Motor Efficiency	90%			
Sizing Factor	1.00			
Fan Design Load CAV	0.3	W/m²	0.03	W/ft²
Fan Design Load VAV	0.0	W/m²	0.00	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	100%	0%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	75%	25%	75%	25%
Comments:				

EXHAUST FANS

Washroom Exhaust	50	L/s.washroom	106	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m²	0.02	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.2	L/s.m²	0.04	CFM/ft²
Exhaust System Static Pressure	125	Pa	0.5	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.1	W/m²	0.01	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.000	kW/kW	0.00	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	0.00	W/m²	0.00	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.000	L/s.m²	0.001	U.S. gpm/ft²
Pump Head Pressure	0	kPa	0	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.00	W/m²	0.00	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.000	L/s.m²	0.0005	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.1	W/m²	0.01	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	2.5	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	0.9	kWh/m².yr
Condenser Pump Energy Consumption	0.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.0	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	0.3	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI	kWh/ft².yr	0.3
	MJ/m².yr	13.4

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Large High Rise	> 9,300 m² (100,000 ft²)		Inland South
Baseline			

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**8.9**	kWh/ft².yr	**344.3**	MJ/m².yr	**Fossil Fue**	**14.2** kWh/ft².yr	**548.9** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL (Linear Fluorescent) LIGHT	0.3	11.7
ARCHITECTURAL (Incandescent & re	1.5	59.7
SPECIAL PURPOSE LIGHTING	0.0	0.0
OTHER PLUG LOADS	1.0	39.5
HVAC FANS & PUMPS	0.3	13.4
REFRIGERATION	0.7	26.0
COMPUTER EQUIPMENT	1.0	37.8
ELEVATORS	0.3	11.6
OUTDOOR LIGHTING	0.4	17.0

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	0.8	31.7	7.5	289.6
SPACE COOLING	0.1	3.8	0.0	0.0
DOMESTIC HOT WATER	1.3	50.0	5.4	209.3
FOOD SERVICE EQUIPMENT	0.7	27.0	0.3	10.0
MISCELLANEOUS	0.4	15.0	1.0	40.0

COMMERCIAL SECTOR BUILDING PROFILE

New BUILDINGS: **SIZE:** **VINTAGE:** **REGION:**
Medium Apartment **Inland North**
Baseline

CONSTRUCTION

Wall U value (W/m².°C)	0.81	W/m².°C	0.14	Btu/hr.ft² . °F
Roof U value (W/m².°C)	0.34	W/m².°C	0.06	Btu/hr.ft² . °F
Glazing U value (W/m².°C)	3.50	W/m².°C	0.62	Btu/hr.ft² . °F
Window/Wall Ratio (WIWAR) (%)	0.25			
Shading Coefficient (SC)	0.65			

Typical Building Size	8,000	m²	86,080	ft²
Typical Footprint (m²)	1,600	m²	17,216	ft²
Footprint Aspect Ratio (L:W)	3			
Percent Conditioned Space	100%			
Percent Conditioned Space Defined as Exterior Zone	45%			
Typical # Stories	5			
Floor to Floor Height (m)	3.7	m	12.0	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	100%		0%		0%		0%		100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	40	m²/person	430	ft²/person
Occupancy Schedule Occ. Period	25%			
Occupancy Schedule Unocc. Period	80%			
Fresh Air Requirements or Outside Air	10	L/s.person	21	CFM/person

%OA 100.00%

Fresh Air Control Type *(enter a 1, 2 or 3) 3
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right:	0%			
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation	0.25	L/s.m²	0.05	CFM/ft²
	75%	operation (%)		

Sizing Factor	1			
Total Air Circulation or Design Air Flow	0.25	L/s.m²	0.05	CFM/ft²
Infiltration Rate	0.05	L/s.m²	0.01	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)		L/s.m²	0.00	CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	0%		100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	1,026,044	
Peak Zone Sensible Load	621,026	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	28,890	
Total air circulation or Design air	1.70	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)	0%	0%

Control mode

	Proportional		PI / PID	Total
Control Mode				0%
	Fixed Discharge		Reset	
Control Strategy				0%

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	23	°C	73.4	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	20.4	°C	68.72	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

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COMMERCIAL SECTOR BUILDING PROFILE

New BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Apartment			Inland North
Baseline			

LIGHTING

GENERAL (Linear Fluorescent) LIGHTING

Light Level	160	Lux	14.9	ft-candles
Floor Fraction (GLFF)	0.10			
Connected Load	4.1	W/m²	0.4	W/ft²
Occ. Period(Hrs./yr.)	3400			
Unocc. Period(Hrs./yr.)	5360			
Usage During Occupied Period	90%			
Usage During Unoccupied Period	90%			

Light Level (Lux)	50	100	200	300	Total
% Distribution	0%	60%	20%	20%	100%
Weighted Average					**160**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			0.0%	0%	100.0%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

Fixture Cleaning:
Incidence of Practice
Interval years

Relamping Strategy & Incidence of Practice: Group | Spot

EUI kWh/ft².yr 0.3
MJ/m².yr 12

ARCHITECTURAL (Incandescent & replacements) LIGHTING

Light Level	130	Lux	12.1	ft-candles
Floor Fraction (ALFF)	0.90			
Connected Load	9.7	W/m²	0.9	W/ft²
Occ. Period(Hrs./yr.)	2900			
Unocc. Period(Hrs./yr.)	5860			
Usage During Occupied Period	25%			
Usage During Unoccupied Period	20%			

Light Level (Lux)	50	200	300	500	Total
% Distribution	60%	20%	20%	0%	100%
Weighted Average					**130**

	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	30%	70%					0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

Fixture Cleaning:
Incidence of Practice
Interval years

Relamping Strategy & Incidence of Practice: Group | Spot

EUI kWh/ft².yr 1.5
EUI = Load X Hrs. X SF X GLFF MJ/m².yr 60

SPECIAL PURPOSE LIGHTING

Light Level	0.00	Lux	0.0	ft-candles
Floor Fraction (HBLFF)	0.00			
Connected Load	0.0	W/m²	0.0	W/ft²
Occ. Period(Hrs./yr.)	4000			
Unocc. Period(Hrs./yr.)	4760			
Usage During Occupied Period	0%			
Usage During Unoccupied Period	100%			

Floor fraction check: should = 1.00 | 1.00

Light Level (Lux)	300	500	700	1000	Total
% Distribution		0%	0%	0%	0%
Weighted Average					**0**

	INC	CFL	T12	T8	T5	MH	HPS	TOTAL
System Present (%)								0.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

Fixture Cleaning:
Incidence of Practice
Interval years

Relamping Strategy & Incidence of Practice: Group | Spot

EUI kWh/ft².yr 0.0
MJ/m².yr 0

TOTAL LIGHTING

Overall LPD 9.16 W/m² | EUI TOTAL kWh/ft².yr 1.8
0.85 W/ft² | MJ/m².yr 71

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Servers		Plug Loads	
Measured Power (W/device)	45		57		100		200		50			
Density (device/occupant)	0.8		0.8		0		0		0.00			
Connected Load	0.9	W/m²	1.1	W/m²	0.0	W/m²	0.0	W/m²	0.5	W/m²	1.8	W/m²
	0.1	W/ft²	0.1	W/ft²	0.00	W/ft²	0.00	W/ft²	0.05	W/ft²	0.17	W/ft²
Diversity Occupied Period	0%		0%		90%		90%		100%		40%	
Diversity Unoccupied Period	50%		50%		50%		10%		100%		85%	
Operation Occ. Period (hrs./year)	2900		2900		2600		2600		2600		3000	
Operation Unocc. Period (hrs./year)	5860		5860		6160		6160		6160		5760	

Total end-use load (occupied period)	1.2	W/m²	0.1	W/ft²
Total end-use load (unocc. period)	3.1	W/m²	0.3	W/ft²
Usage during occupied period	100%			
Usage during unoccupied period	249%			

	EUI		
Computer Equipment	EUI	kWh/ft².yr	0.98
		MJ/m².yr	37.77
Plug Loads	EUI	kWh/ft².yr	1.02
		MJ/m².yr	39.50

FOOD SERVICE EQUIPMENT

Provide description below:
Electric stoves (at 417 kWh/yr), etc.

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	0.1	EUI	kWh/ft².yr	0.7
	MJ/m².yr	5.0		MJ/m².yr	27.0

REFRIGERATION

Provide description below:
Residential refrigerators (560 kWh/yr) and freezers (370 kWh/yr)

EUI kWh/ft².yr 0.7
MJ/m².yr 26.0

MISCELLANEOUS

Provide description below:

Gas EUI			Electric EUI		
EUI	kWh/ft².yr	0.8	EUI	kWh/ft².yr	0.0
	MJ/m².yr	30.0		MJ/m².yr	

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COMMERCIAL SECTOR BUILDING PROFILE

New BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Apartment			Inland North
Baseline			

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric			Other	
	Boilers			Forced Air						District	Total
	Stan.	High	Cond.	RTU	Furnace	Unit Heater	A/A HP	W. S. HP	Resistance	Heat	
System Present (%)	5%	30%	10%	20%	15%	0%	3%	3%	14%	0%	100%
Seasonal Eff./COP	75%	80%	90%	75%	80%	80%	1.70	3.00	100%	70%	
Performance (1 / Eff. (kW/kW)	1.33	1.25	1.11	1.33	1.25	1.25	0.59	0.33	1.00	1.43	

Peak Heating Load	40.0	W/m²	12.7	Btu/hr.ft²
Seasonal Heating Load (Tertiary Load)	406	MJ/m².yr	10.5	kWh/ft².yr
Sizing Factor	1.00			

Electric Fuel Share 20.0% Fossil Fuel Share 80.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	8.8
MJ/m².yr	340

Gas EUI	
kWh/ft².yr	13.2
MJ/m².yr	510

Market Composite EUI	
kWh/ft².yr	12.3
MJ/m².yr	476

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	1.0%	0.0%		5.0%	94.0%	0.0%	0.0%	100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7	°C	44.6	°F
Condenser Water	30	°C	86	°F
Supply Air	14.0	°C	57.2	°F

Peak Cooling Load	6	W/m²	2	Btu/hr.ft²	6712	ft²/Ton
Seasonal Cooling Load (Tertiary Load)	50.8	MJ/m².yr	1.3	kWh/ft².yr		

Sizing Factor 0.15 Operation (occ. period) 3000 hrs/year Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C) 15.0%

Electric Fuel Share 100.0% Gas Fuel Share 0.0%

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenanc

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	0.3
MJ/m².yr	13

Natural Gas EUI	
kWh/ft².yr	0.0
MJ/m².yr	0

Market Composite EUI	
kWh/ft².yr	0.3
MJ/m².yr	13

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	60%				20%
Eff./COP	0.65				0.75

	Fossil		Elec. Res.
Fuel Share	80%		20%
Blended Efficiency	0.68		1.00

Service Hot Water load (MJ/m².yr) (Tertiary Load) 180.0

Wetting Use Percentage 80%

All Electric EUI	
kWh/ft².yr	4.6
MJ/m².yr	180

Fossil Fuel EUI	
kWh/ft².yr	6.9
MJ/m².yr	267

Market Composite EUI	
kWh/ft².yr	6.4
MJ/m².yr	249.3

New BUILDINGS:	SIZE:	VINTAGE:	REGION:
Medium Apartment			Inland North
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	0.3	L/s.m²	0.05	CFM/ft²
System Static Pressure CAV	625	Pa	2.5	wg
System Static Pressure VAV	0	Pa	0.0	wg
Fan Efficiency	52%			
Fan Motor Efficiency	90%			
Sizing Factor	1.00			
Fan Design Load CAV	0.3	W/m²	0.03	W/ft²
Fan Design Load VAV	0.0	W/m²	0.00	W/ft²

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	100%	0%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	75%	25%	75%	25%
Comments:				

EXHAUST FANS

Washroom Exhaust	50	L/s.washroom	106	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m²	0.01	CFM/ft²
Other Exhaust (Smoking/Conference)	0.1	L/s.m²	0.02	CFM/ft²
Total Building Exhaust	0.2	L/s.m²	0.03	CFM/ft²
Exhaust System Static Pressure	125	Pa	0.5	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.1	W/m²	0.01	W/ft²

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.000	kW/kW	0.00	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	0.00	W/m²	0.00	W/ft²

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.000	L/s.m²	0.000	U.S. gpm/ft²
Pump Head Pressure	0	kPa	0	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	0.00	W/m²	0.00	W/ft²

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.000	L/s.m²	0.0004	U.S. gpm/ft²	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.0	W/m²	0.00	W/ft²		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	2.5	kWh/m².yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	0.8	kWh/m².yr
Condenser Pump Energy Consumption	0.0	kWh/m².yr
Cooling Tower /Condenser Fans Energy Consumption	0.0	kWh/m².yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	0.2	kWh/m².yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI		
	kWh/ft².yr	0.3
	MJ/m².yr	12.7

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COMMERCIAL SECTOR BUILDING PROFILE

New BUILDINGS: **SIZE:** **VINTAGE:** **REGION:**
Medium Apartment **Inland North**
Baseline

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	**9.0**	kWh/ft².yr	**349.0**	MJ/m².yr	**Fossil Fue**	**17.0** kWh/ft².yr	**656.7** MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL (Linear Fluorescent) LIGHT	0.3	11.7
ARCHITECTURAL (Incandescent & re	1.5	59.7
SPECIAL PURPOSE LIGHTING	0.0	0.0
OTHER PLUG LOADS	1.0	39.5
HVAC FANS & PUMPS	0.3	12.7
REFRIGERATION	0.7	26.0
COMPUTER EQUIPMENT	1.0	37.8
ELEVATORS	0.3	11.6
OUTDOOR LIGHTING	0.4	17.0

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	1.8	68.0	10.5	408.4
SPACE COOLING	0.1	2.0	0.0	0.0
DOMESTIC HOT WATER	0.9	36.0	5.5	213.3
FOOD SERVICE EQUIPMENT	0.7	27.0	0.1	5.0
MISCELLANEOUS	0.0	0.0	0.8	30.0

Appendix C Background – Section 5: Efficiency & Alternative Energy Technologies

Introduction

This section includes short narrative descriptions of the energy-efficiency measures examined in this study. The list of measures is reproduced for reference in Exhibit 60 below. For full descriptions of measure baselines, upgrades, as well as the financial, economic and energy analysis, readers are encouraged to review the Measure TRC model Excel file that accompanies this report.

Exhibit 60 Efficiency and Alternative Energy Technologies Included in This Study

Space Heating
- Near-condensing boilers
- Condensing boilers
- Condensing unit heaters
- High-efficiency rooftop units
- Condensing rooftop units
- Infrared heaters
- High-efficiency forced air furnaces
- Absorption heat pumps
- Micro-combined heat & power
- Solar pre-heated make-up air
- Air-to-air heat recovery
- Demand-controlled ventilation
- Demand-controlled kitchen ventilation
- HVLS fans
- Programmable thermostats

Building Envelope
- High-performance glazings
- Super high-performance glazings
- Wall insulation upgrade
- Roof insulation upgrade
- Air sealing

Water Heating
- Condensing DHW boilers
- Condensing tank-type water heaters
- Tankless water heaters
- Drainwater heat recovery
- Low-flow faucet aerators and showerheads
- Low-flow pre-rinse spray valves
- Solar hot water heating

Cooking
- High-efficiency cooking equipment

Whole Building
- New construction – 25% more efficient
- New construction – 40% more efficient
- Recommissioning and advanced building automation (BAS)
- O&M

Space Heating Measures

Near-condensing Boilers

Near-condensing boilers present a significant efficiency gain over a standard-efficiency boiler without some of the additional considerations required for a full condensing boiler while providing a competitive cost.

Condensing Boilers

Condensing boilers provide the highest efficiency option available in today's market with thermal efficiencies reaching as high as 98% depending on conditions.

Condensing Unit Heaters

Relatively new to the market, condensing unit heaters provide a high-efficiency option for high-bay areas that have typically been served by standard-efficiency unit heaters.

HE Rooftop Units

Rooftop units are the most common form of HVAC and new developments such as modulating burners are becoming widely available and can raise the seasonal burner efficiency.

Condensing Rooftop Units

Rooftop units are the most common form of HVAC and condensing burners represent the highest efficiency available in today's market. This market hasn't reached maturity and is typically relegated to the high-energy use 100% outdoor air custom HVAC units.

Infrared Heaters

Radiant infrared heaters can be used as primary heating sources or in applications where supplementary or spot heating is required. Radiant heating systems offer energy savings because building occupants feel comfortable at lower air temperatures in radiantly heated spaces.

HE (Condensing) Forced-air Furnace

Federal legislation now requires that all residential furnaces meet the minimum performance standard of 90% AFUE. However, higher efficiency condensing furnaces are available. These furnaces include more advanced heat exchanger designs that extract more heat from the flue gases before they are exhausted.

Gas-fired (Absorption) HP

Gas absorption heat pumps can offset electricity load, using a natural gas burner as a heat source as opposed to an electrical compressor.

Micro-combined Heat & Power (CHP)

Micro-CHP units, such as Honda's Freewatt, combine natural gas or propane furnaces/boilers along with electrical generators to make the best use of available fuel.

Solar Pre-heated Make-up Air

Solar walls consist of cladding placed on a southern exposure of a building to pre-heat ventilation air, usually for 100% outdoor air applications such as a warehouse.

Air-to-Air Heat Recovery

Heat recovery allows facilities to reduce their energy consumption while maintaining the same ventilation levels, transferring heat from exhaust air to intake air.

Demand-control Ventilation

Ventilation units are typically sized for a peak load to ensure ample service when necessary. However, actual use is usually well below this and over ventilation can occur, using energy unnecessarily to heat this excess air. Demand-controlled ventilation systems use CO_2 sensors to ensure high air quality and minimal costs.

Demand-control Kitchen Ventilation

Kitchen ventilation hoods are typically sized to remove the heat created when all the kitchen equipment is in operation, a condition that occurs only during peak service times. During the downtime, a demand-controlled ventilation system can significantly reduce the excess airflow and reduce energy costs.

High-volume Low-speed Fans

The stratification effect in warehouses or other high-ceiling spaces can cause the area near the roof to be from 6-11°C higher during the heating season, causing occupant discomfort as well as excessive heat loss through the roof. HVLS fans act to reduce this stratification.

Programmable Thermostats

Programmable thermostats can help occupants better control their space temperature while incorporating shutdown/setback abilities.

Building Envelope

High-performance (HP) Glazing

HP glazings refer to a variety of technologies that can be used alone or in combination to provide an array of benefits, including lower energy costs, enhanced daylighting opportunities, reduced heating and cooling loads, and more comfortable spaces. They incorporate one or more of the following:

- Double or triple glazing with a sealed insulating glass unit
- Low-E glass
- Inert gas such as argon or krypton in the sealed unit
- Low conductivity or "warm edge" spacer bars
- Insulated frames and sashes.

Combining some of these features can lead to windows with U-values of 0.32 Btu/hr.ft^2.^{o}F or lower.

Super High-performance (HP) Glazing

Super HP glazings refer to a variety of technologies that can be used alone or in combination to provide an array of benefits, including lower energy costs, enhanced daylighting opportunities, reduced heating and cooling loads, and more comfortable spaces. They incorporate one or more of the following:

- Double or triple glazing with a sealed insulating glass unit
- Low-E glass
- Inert gas such as argon or krypton in the sealed unit
- Low conductivity or "warm edge" spacer bars
- Insulated frames and sashes.

When several of these features are combined, windows with U-values of 0.20 Btu/hr.ft^2.^{o}F or lower are possible.

Wall Insulation Upgrade

Various insulating materials and methods can be used to upgrade wall insulation, including applying rigid polystyrene board to the exterior of a building or installing fibreglass batts between interior wall studs. In addition to superior insulating performance and lower energy costs, the co-benefits include enhanced comfort, noise reduction and reduced HVAC equipment costs.

This measure involves upgrading wall insulation to R-22 (an additional R-10).

Wall Insulation Upgrade

Upgrading insulation on a built-up roofing system typically involves adding additional layers of rigid insulation at the time of re-roofing. This measure involves upgrading roof insulation with the equivalent of two inches of rigid polystyrene (an additional R-10).

Air Sealing

Air sealing is a simple building envelope measure that seals air leakage that arises around doors and windows as a result of building wear.

Water Heating

Condensing DHW Boilers
In larger facilities, domestic water is often provided by a separate boiler with a large insulated storage tank. Condensing boilers can provide large amounts of DHW at a high efficiency.

Condensing Tank Type Water Heaters
Condensing tank-type DHW heaters provide very high efficiency with a compact tank arrangement.

Tankless Water Heaters
Tankless DHW heaters can provide very high efficiency with a very compact tankless arrangement and are a suitable replacement for residential-style DHW heaters used commonly in the Commercial sector.

Drainwater Heat Recovery
For applications like showering, up to 90% of the energy used for water heating is wasted down the drain. Several companies provide products that replace a section of vertical drainpipe with a heat exchanger, harvesting heat and returning it to the hot water tank. This measure assumes that a standard-efficiency natural gas heater is providing all domestic hot water at an energy factor of 0.69.

Low-flow Faucet Aerators and Showerheads
Hand washing contributes a significant portion of Commercial sector building water use and can be considerably reduced through the use of easy to install faucet aerators.

Showers in commercial facilities such as hotels can contribute significantly to domestic hot water loads and efficient alternatives are readily available.

For this measure, a standard-efficiency DHW heater with an energy factor (EF) of 0.69 is used.

Low-flow Pre-Rinse Spray Valves
Pre-rinse spray valves are used in nearly every restaurant and hotel in British Columbia. Low-flow options are an inexpensive way to curtail both water and natural gas use.

Solar HW Pre-heat
Solar water pre-heat is the most efficient renewable technology currently on the market, avoiding the need to convert sunlight to electricity but instead converting directly to heat. Solar thermal systems pre-heat make-up water to an intermediate temperature, reducing the operation of the standard hot water heater.

Cooking

High-efficiency Cooking Equipment
Major cooking appliances include fryers, griddles, ranges and ovens. Most cooking appliances are evaluated in terms of “cooking efficiency,” which is the ratio of energy added to food being cooked to the energy supplied to the appliance during cooking. Cooking efficiency of cooking equipment may be improved in two main ways: 1) increased insulation minimizes heat loss and improves energy performance in the idling state and 2) improved controls may reduce "on time" by sensing the presence of a cooking load and avoiding overheating.

Whole Building

New Construction - 25% More Efficient

High-performance new building construction refers to new high-efficiency buildings that are designed using the integrated design process. Through the application and integration of energy-efficiency technologies and design approaches, high-efficiency buildings that use this process can achieve substantial improvements over conventional new buildings. The co-benefits include lower operations and maintenance costs, and enhanced occupant productivity and health.

New Construction - 40% More Efficient

High-performance new building construction refers to new high-efficiency buildings that are designed using the integrated design process. Through the application and integration of energy-efficiency technologies and design approaches, high-efficiency buildings that use this process can achieve substantial improvements over conventional new buildings. The co-benefits include lower operations and maintenance costs, and enhanced occupant productivity and health.

Recommissioning (RCx) and Advanced Building Automation Systems (BAS)

Recent developments in BAS have unlocked the potential to exploit incremental energy uses in the building such as timed setbacks, automatic temperature resets and better adjustments to changing operating conditions.

Note that this combines BAS and RCx. Many of the general non-BAS related measures are covered in the O&M processes.

Operations and Maintenance (O&M)

While capital equipment replacement typically dominates energy-efficiency spending, O&M upgrades can unlock the potential of these capital expenditures as well as provide significant benefits at low or no incremental cost. These include (but are not limited to):

- Recommissioning time clocks and sensors
- Introducing a regular preventative maintenance program
- Eliminating simultaneous heating and cooling.

Appendix D Background – Section 6: Economic Potential Forecast

Introduction

This appendix provides a detailed mapping of how energy-efficiency measures were applied in the Economic Potential Forecast. Exhibit 61 provides this mapping by region, while Exhibit 62 provides a mapping by sub sector. In both cases, a ✓ symbol indicates that the measure is applied in the region/sub sector.

Exhibit 61 Efficiency and Alternative Energy Technologies – Application by Region

Measure	Northern Interior	Southern Interior	Vancouver Island	Lower Mainland
Air sealing	✓	×	×	×
Air-to-air heat recovery	✓	✓	✓	✓
BAS and RCx	✓	✓	✓	✓
Condensing boilers	✓	✓	✓	✓
Condensing DHW (boiler)	✓	✓	✓	✓
Condensing DHW (tank type)	✓	✓	✓	✓
Condensing rooftops	✓	✓	×	×
Condensing UH	✓	✓	✓	✓
DCKV	✓	✓	✓	✓
Demand Ctrl Vent.	✓	✓	×	×
Drainwater HR	✓	✓	✓	✓
High-efficiency cooking	✓	✓	✓	✓
High-performance glazings	✓	×	×	×
HVLS fans	✓	✓	✓	✓
Infrared heaters	✓	✓	✓	✓
Low-flow fixtures	✓	✓	✓	✓
New construction 40% better	✓	✓	✓	✓
O&M	✓	✓	✓	✓
Pre-rinse spray valves	✓	✓	✓	✓
Programmable thermostats	✓	✓	✓	✓
Roof insulation	✓	✓	✓	×

Exhibit 62 Efficiency and Alternative Energy Technologies – Application by Sub Sector

Measure	Large Office	Medium Office	Large Non-food Retail	Medium Non-food Retail	Food Retail	Large Hotel	Medium Hotel	Hospital	Nursing Home	Large School	Medium School	University/College	Restaurant	Warehouse/Wholesale	Large Apartment	Medium Apartment
Air sealing	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Air-to-air heat recovery	×	×	×	×	×	×	×	✓	✓	×	×	×	×	×	✓	✓
BAS and RCx	✓	×	✓	×	✓	✓	×	✓	✓	✓	×	✓	×	✓	✓	×
Condensing boilers	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Condensing DHW (boiler)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Condensing DHW (tank type)	×	×	×	×	×	×	✓	×	✓	✓	×	✓	✓	×	✓	✓
Condensing rooftops	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Condensing UH	×	×	×	×	×	×	×	×	×	×	×	×	×	✓	×	×
DCKV	×	×	×	×	×	×	×	×	×	×	×	×	✓	×	×	×
Demand Ctrl Vent.	✓	✓	✓	✓	✓	✓	✓	×	×	✓	✓	✓	×	×	×	×
Drainwater HR	×	×	×	×	×	✓	×	✓	✓	×	×	×	×	×	×	×
High-efficiency cooking	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
High-performance glazings	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
HVLS Fans	×	×	×	×	×	×	×	×	×	×	×	×	×	✓	×	×
Infrared heaters	×	×	×	×	×	×	×	×	×	×	×	×	×	✓	×	×
Low-flow fixtures	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
New construction 40% better	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
O&M	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Pre-rinse spray valves	×	×	×	×	✓	✓	✓	✓	✓	✓	✓	✓	✓	×	×	×
Programmable thermostats	×	✓	×	✓	×	×	✓	×	×	×	✓	×	✓	×	×	✓
Roof insulation	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Appendix E Background – Section 7: Achievable Potential Forecast

Introduction

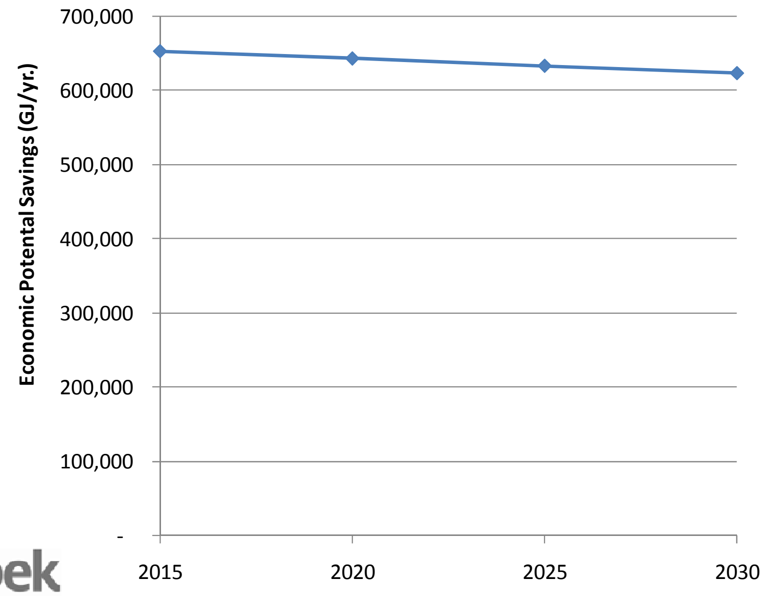
This appendix provides workshop materials from the Commercial sector Achievable Potential workshop conducted on January 26, 2011.

Exhibit 63 through Exhibit 70 show the slides that were prepared before the Achievable Potential workshop to provide participants with background information on each of the measures discussed.

Exhibit 71 through Exhibit 78 show the worksheets that were prepared before the Achievable Potential workshop to provide a structured format in which to record the results of the discussions on each measure. Workshop results and discussion highlights, as recorded during the discussions, are included in the exhibits.

Exhibit 62 Commercial Opportunity Profile, Opportunity 1

Commercial Opportunity 1: Ultra Low-Flow Fixtures



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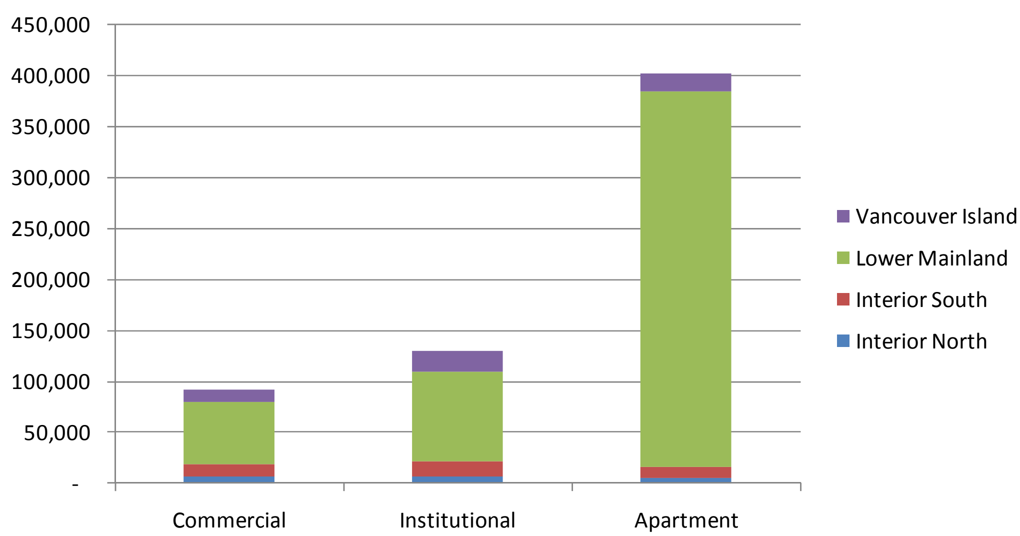
Commercial Opportunity 1: Ultra Low-Flow Fixtures



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Commercial Opportunity 1: Ultra Low-Flow Fixtures

- Technology Description
  - Measure involves limiting an existing 8.3 LPM (2.2 GPM) faucet to 3.8 LPM (1 GPM) using an aerator.
- Discussion Sub Sector – Large Apartment, LM
- Typical Application
  - Cost: estimated full cost of $10/$25 installed (aerator/showerhead)
  - Useful life: 5/10 years (aerator/showerhead)
  - Savings: approx 55%/50% of faucet/shower hot water use

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Commercial Opportunity 1: Ultra Low-Flow Fixtures

- Financial & Economic Indicators
  - Approx. 10 month simple payback
  - B/C ratio = 4.8
  - Basis of assessment: Full Cost
- Approximate Number of Eligible Participants
  - 135 Large Apartment Buildings
  - Eligible immediately

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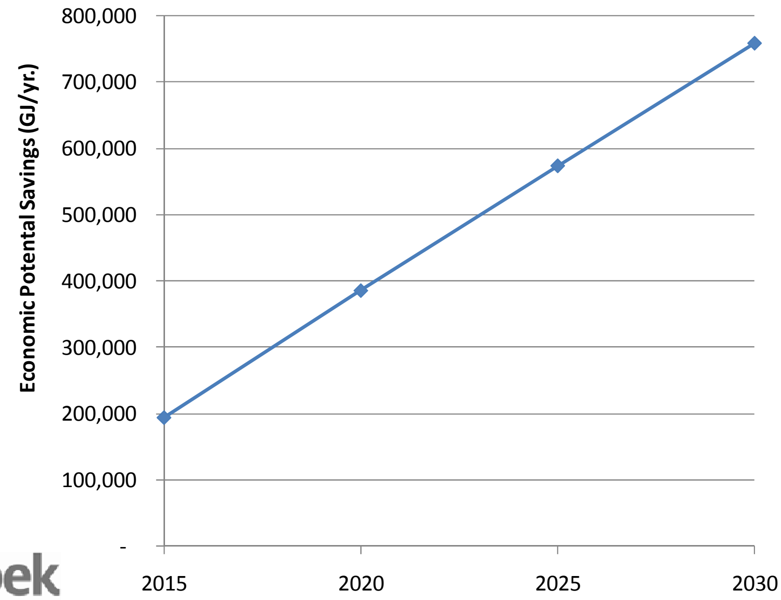
Exhibit 63 Commercial Opportunity Profile, Opportunity 2

Commercial Opportunity 2: Roof Insulation



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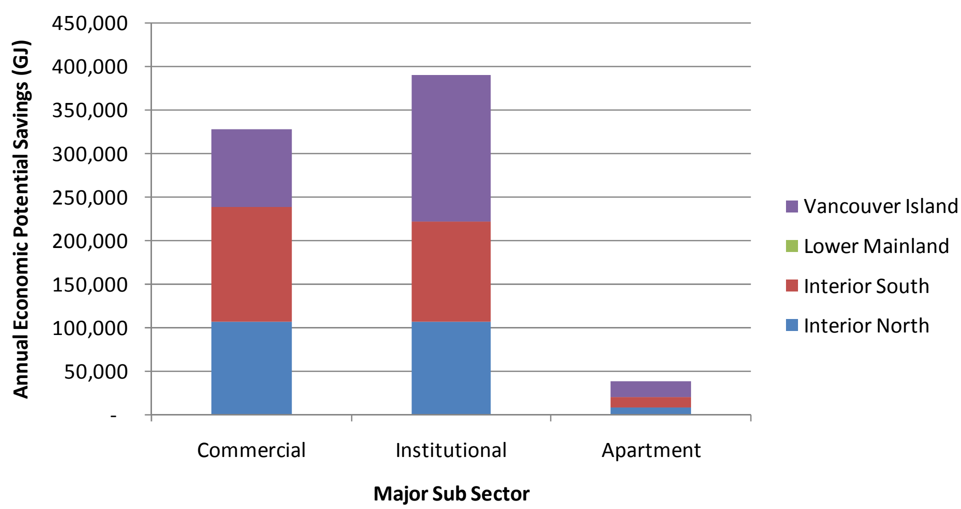
Commercial Opportunity 2: Roof Insulation



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Commercial Opportunity 2: Roof Insulation

- Technology Description
  - Measure involves upgrading roof insulation to R-20 at time of re-roofing
- Discussion Sub Sector – Medium Office, VI, IN, IS
- Typical Application
  - Cost: estimated at $1/ft^2 of roof (incremental)
  - Useful life: 20 years
  - Savings: approx 50% of heat lost through roof (estimated 8% of space heating load for medium office)

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Commercial Opportunity 2: Roof Insulation

- Financial & Economic Indicators
  - 4.7 – 7.2 yrs simple payback dependent on region
  - B/C ratio = 1.03 - 1.61
  - Basis of assessment > Incremental
- Approximate Number of Eligible Participants
  - 480 roofs total (VI, IS, IN)
  - Approximately 25 sites eligible to 1st milestone year, 2015. 100 sites to 2030 milestone year.

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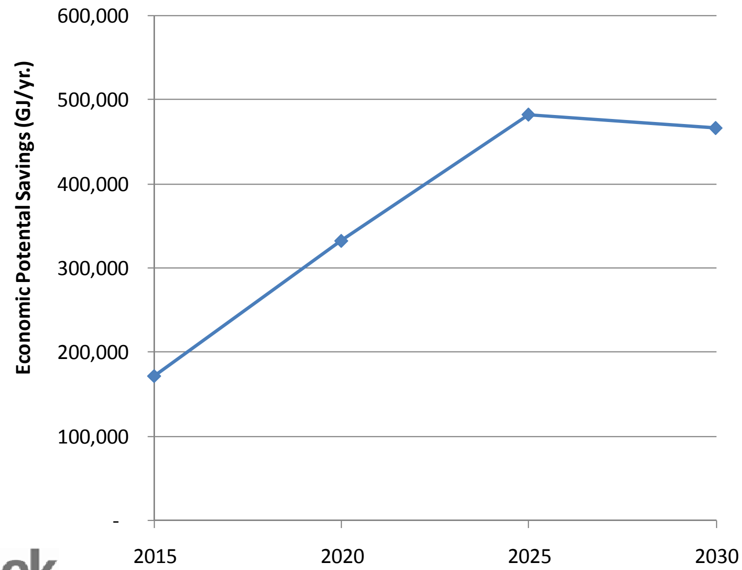
Exhibit 64 Commercial Opportunity Profile, Opportunity 3

Commercial Opportunity 3: Condensing DHW (Tank)



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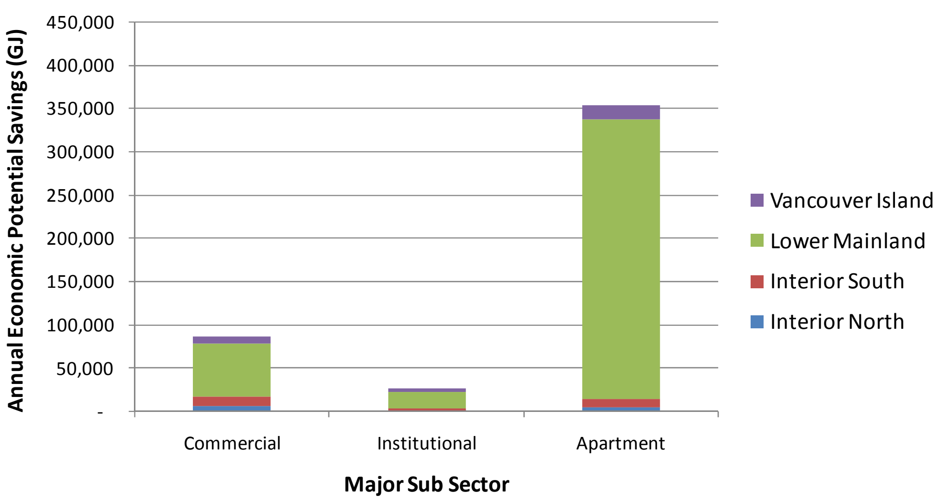
Commercial Opportunity 3: Condensing DHW (Tank)



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Commercial Opportunity 3: Condensing DHW (Tank)

- Technology Description
  - Measure involves upgrading to a condensing DHW Boiler at time of equipment turnover
- Discussion Sub Sector – Large Apartment, LM
- Typical Application
  - Cost: estimated at $16/MBH (incremental)
  - Useful life: 15 years
  - Savings: approx 20% of DHW Energy

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Commercial Opportunity 3: Condensing DHW (Tank)

- Financial & Economic Indicators
  - 2.4 – 7.2 yrs simple payback dependent on usage
  - B/C ratio = 0.9 – 2.6
  - Basis of assessment > Incremental
- Approximate Number of Eligible Participants
  - 220 buildings total
  - Approximately 75 Large Apartment buildings eligible by 2015, 220 by 2030.

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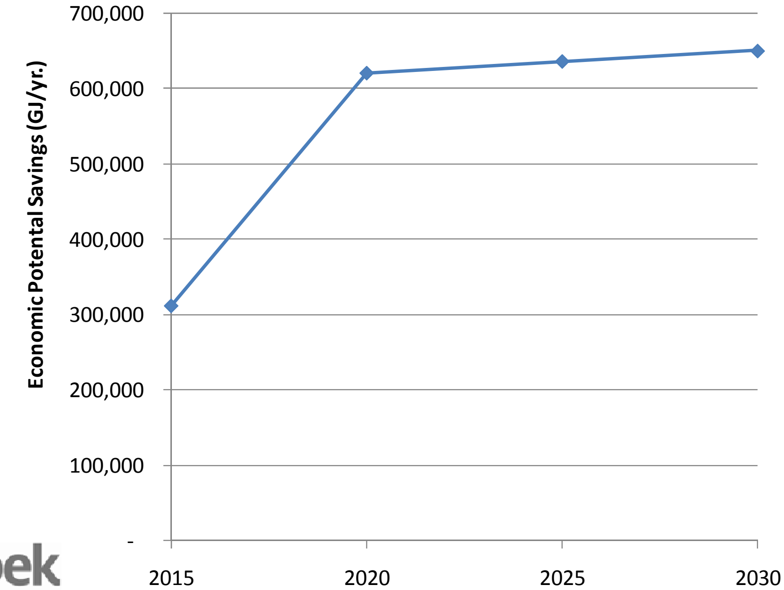
Exhibit 65 Commercial Opportunity Profile, Opportunity 4

Commercial Opportunity 4: HE Cooking Equipment



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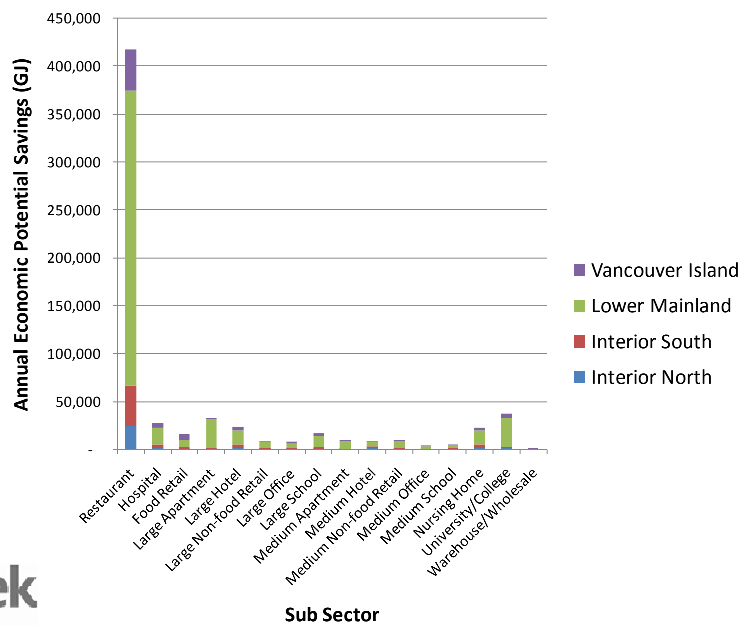
Commercial Opportunity 4: HE Cooking Equipment



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Commercial Opportunity 4: HE Cooking Equipment

- Technology Description
  - Measure involves upgrading to an HE cooking equipment at time of equipment turnover.
- Discussion Sub Sector – Restaurant, LM
- Typical Application
  - For example: ENERGY STAR fryers
    - Cost: estimated at $1,100/unit (incremental)
    - Useful life: 10 years
    - Savings: approx 22% of Cooking Energy

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Commercial Opportunity 4: HE Cooking Equipment

- Financial & Economic Indicators
  - 3.1 yrs simple payback (dependent on usage)
  - B/C ratio = 1.5
  - Basis of assessment > Incremental
- Approximate Number of Eligible Participants
  - 5700 buildings total
  - Approximately 570 buildings eligible yearly (Notionally 3000 pieces of equipment yearly, 14,000 to 1st milestone year – 2015)

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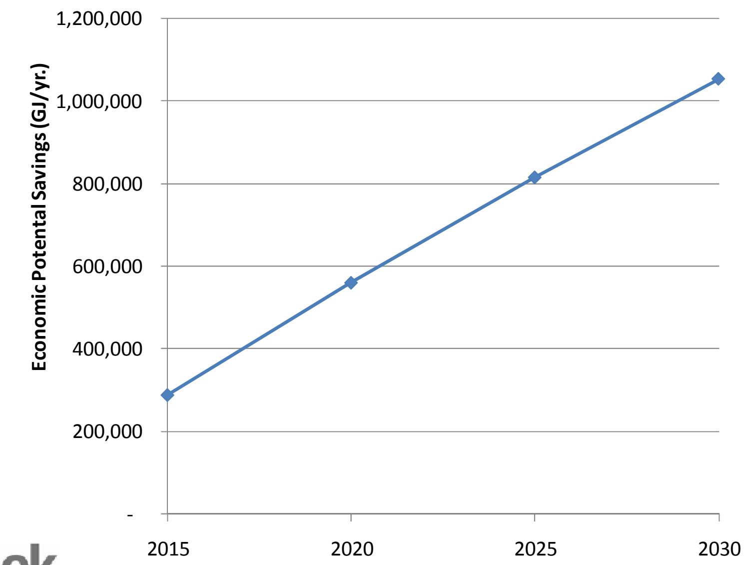
Exhibit 66 Commercial Opportunity Profile, Opportunity 5

Commercial Opportunity 5: HE Boilers



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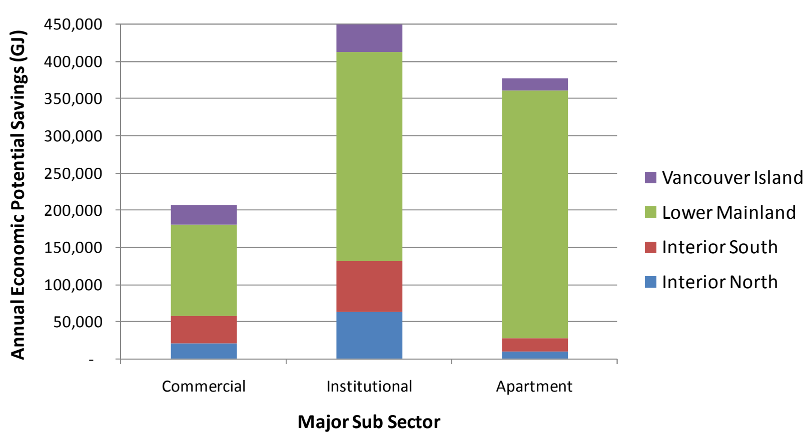
Commercial Opportunity 5: HE Boilers



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Commercial Opportunity 5: HE Boilers

- Technology Description
  - Measure involves upgrading to a condensing or near-condensing boiler at the time of equipment replacement
- Discussion Sub Sector – Large Office, LM
- Typical Application
  - Cost: estimated at $17/MBH and $3/MBH (incremental) for condensing and near-condensing respectively
  - Useful life: 25 years
  - Savings: approx 24% and 15% of Space Heating Energy for condensing and near-condensing respectively

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Commercial Opportunity 5: HE Boilers

- Financial & Economic Indicators
  - 4.7 / 1.3 yrs simple payback for condensing and near-condensing respectively (dependent on region)
  - B/C ratio = 6.4 / 1.8 for condensing and near-condensing respectively
  - Basis of assessment > Incremental
- Approximate Number of Eligible Participants
  - 480 buildings total
  - Approximately 20 buildings eligible yearly (100 to 1st milestone year – 2015)

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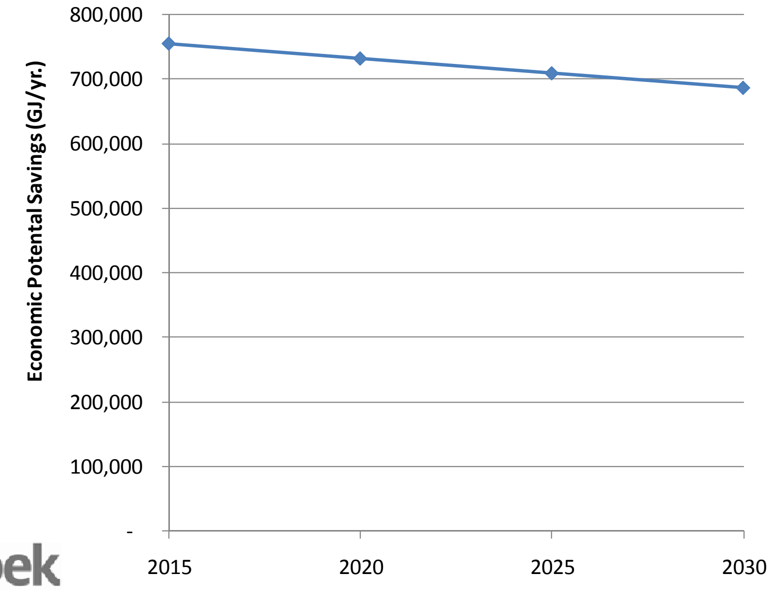
Exhibit 67 Commercial Opportunity Profile, Opportunity 6

Commercial Opportunity 6: Recommissioning



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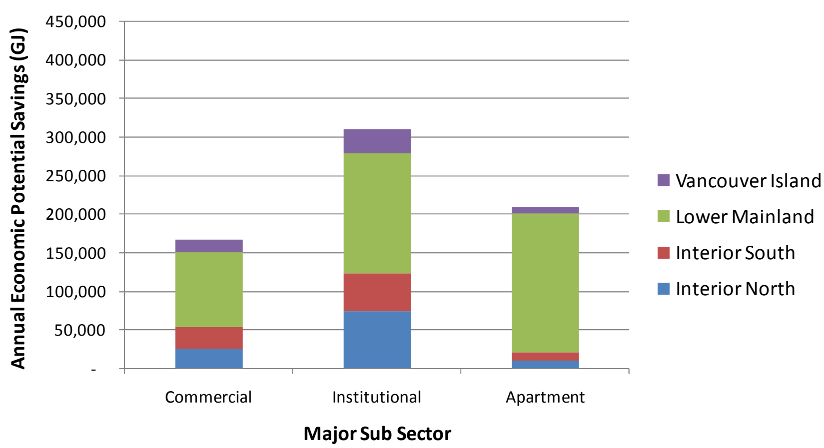
Commercial Opportunity 6: Recommissioning



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Commercial Opportunity 6: Recommissioning

- Technology Description
  - Measure involves applying the retrocommissioning process to an existing building and/or installing an advanced building automation system (BAS)
- Discussion Sub Sector – Large Office, LM
- Typical Application
  - Cost estimated at $0.15/ft^2$
  - Useful life is 15 years (BAS) & 5 years (RCx) respectively
  - Typical savings of 10% of total gas use

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Commercial Opportunity 6: Recommissioning

- Financial & Economic Indicators
  - 1.7 yrs simple payback (dependent on region)
  - B/C ratio = 3.7
  - Basis of assessment > Full cost
- Approximate Number of Eligible Participants
  - 130 buildings total
  - All buildings eligible immediately

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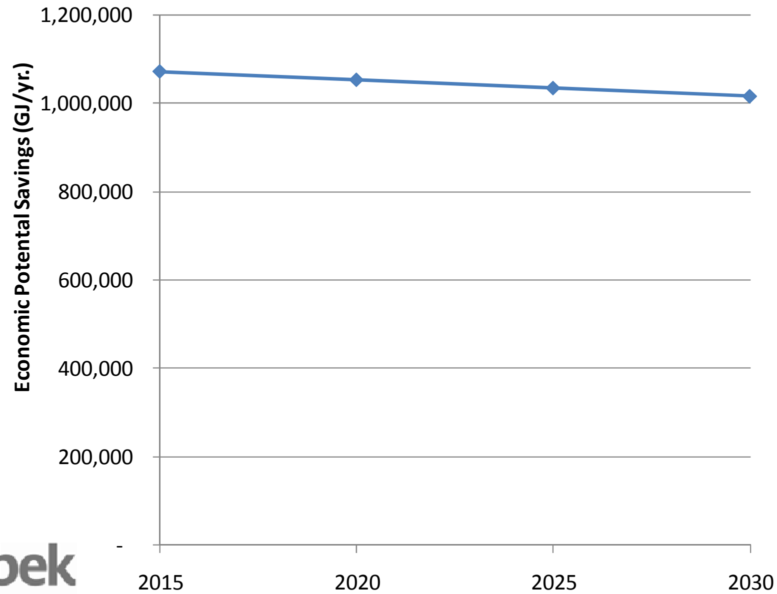
Exhibit 68 Commercial Opportunity Profile, Opportunity 7

Commercial Opportunity 7: O&M Measures



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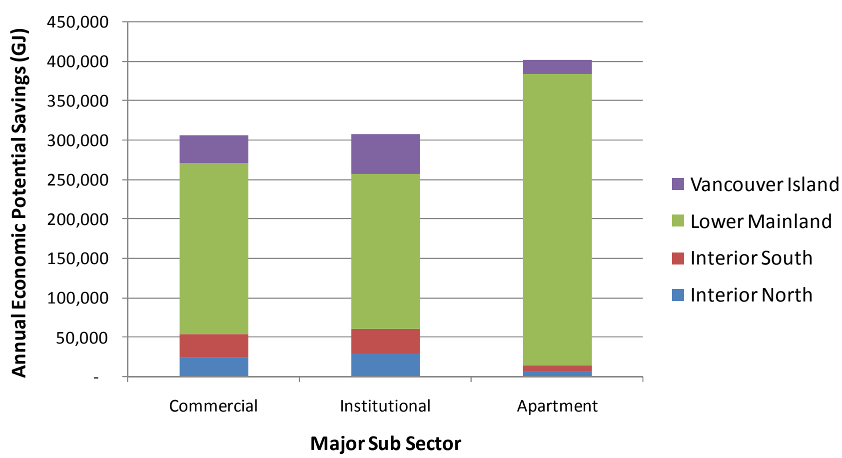
Commercial Opportunity 7: O&M Measures



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Commercial Opportunity 7: O&M Measures

- Technology Description
  - Measure involves undertaking the low or no cost measures such as cleaning heating coils, eliminating simultaneous heating & cooling, setback of DHW equipment.
- Discussion Sub Sector – Large Office, LM
- Typical Application
  - Cost estimated at $0.01/ft^2 (mix of no & low-cost measures)
  - Useful life is 1 year
  - Typical savings of 5% of total gas use

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Commercial Opportunity 7: O&M Measures

- Financial & Economic Indicators
  - 3 month simple payback
  - B/C ratio = 1.9
  - Basis of assessment > Full cost
- Approximate Number of Eligible Participants
  - 110 buildings total
  - All buildings eligible immediately

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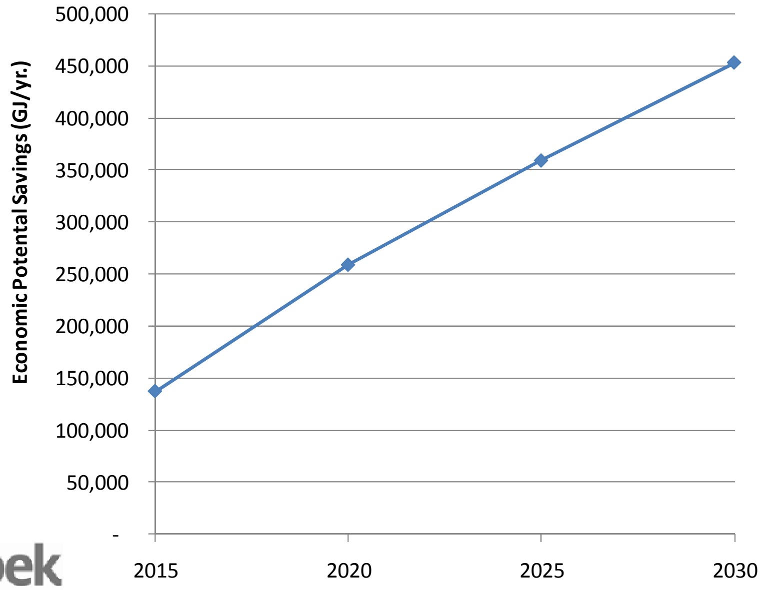
Exhibit 69 Commercial Opportunity Profile, Opportunity 8

Commercial Opportunity 8: New Construction Measures



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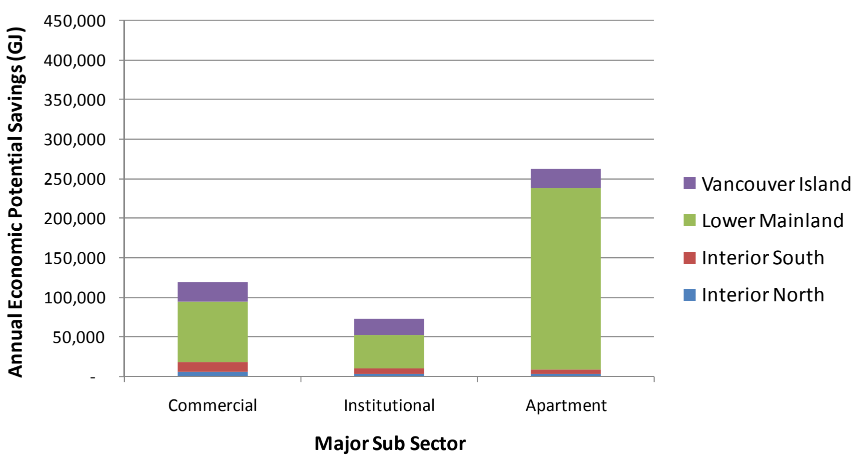
Commercial Opportunity 8: New Construction Measures



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Commercial Opportunity 8: New Construction Measures

- Technology Description
  - Measure involves constructing new commercial buildings using an integrated design process to lower overall energy use. Two measures are examined: 40% better and 25% better than baseline construction.
- Discussion Sub Sector(s) – All, LM
- Typical Application
  - Cost estimated at \$1.50/ft^2 & \$4.50/ft^2 for 25% and 40% respectively
  - Useful life is 30 years

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Commercial Opportunity 8: New Construction Measures

- Financial & Economic Indicators
  - 3.4 & 6.4 year simple payback for 25% and 40% respectively
  - B/C ratios = 5.7 and 3.0
  - Basis of assessment > Incremental Cost
- Approximate Number of Eligible Participants
  - Approx 150 100,000 ft^2 buildings total per milestone period
  - All buildings eligible immediately

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Exhibit 71 Commercial Achievable Worksheet, Opportunity 1

Commercial Sector
C1 -- Ultra Low-Flow Fixtures

General Measure Information				
Approximate Economic Savings Potential (GJ/yr) in 2030	DHW - Low Flow Fixtures	624,000		
Benefit/Cost ratio	ULF Faucet Aerators	7.9		Full
	ULF Showerheads	1.7		Full
Approx. payback (months)	ULF Faucet Aerators	2		
	ULF Showerheads	18		
Sub Sector for Discussion: Fixtures > Large Apartment > Existing > Lower Mainland				
Measure information	Benefit/Cost Ratio	4.8		Full Cost
	Approx. Payback (months)	10		
Approximate Economic Savings Potential (GJ/yr) in 2015		249,700		
Approximate Economic Savings Potential (GJ/yr) in 2030		238,300		
Market Size	Total ft^2 (approx.)	165,932,658		
	Total # of sites	720		Eq. 230,000 ft^2 buildings
	% eligible	19%		Exclude "can't" + current
	# eligible sites by 2015	135		
	# eligible sites by 2030	135		
Participation Rates, by Year (% of Eligible Sites)		**2011-2015**	**2026-2030**	**Curve**
ULF Fixtures	Common Sense	14%	55%	Curve A
	Aggressive	20%	80%	Curve A
Achievable Potential (# Buildings)				
ULF Fixtures	Common Sense	19	74	
	Aggressive	27	108	

Participation Rates for Other Subsectors/Regions (H=higher; L=lower; S=same; N/A=not applicable)			
Large Office	Higher	Hospital	Higher
Medium Office	Higher	Nursing Home	Higher
Large Non-food Retail		Large School	Higher
Medium Non-food Retail		Medium School	Higher
Food Retail		University/College	Higher
Large Hotel	Higher, but not as much as	Large Apartment	
Medium Hotel	Higher, but not as much as	Medium Apartment	Higher
Restaurant			
Warehouse/Wholesale		Vancouver Island	Higher
		Inland North	Lower
		Inland South	Same

Program Implementation Considerations		
Sensitivity to Incentives	(High Medium Low)	
Primary Incentive Target	(User, Channel Member, Both)	
Sensitivity to Direct Program Support	(High Medium Low)	
Most Critical Program Support Type(s)	(e.g., Trade Ally Training, Certification, Technical Workshops, etc.)	

Notes:
•Would have to be a direct install program.
•Ownership patterns are a challenge. In fact, buildings where all suites are rental and the whole thing is owned by one owner, the situation is actually easier than for the strata buildings.
•By 2030 this is an issue but it's not impossible: it's an issue of contacting possibly multiple owners, and the occupants, booking a time to get into the suites, obtaining releases, etc.
•Other challenge is the perception of low-flow fixtures, which are often perceived not to work very well. This is probably more of a challenge for the high-end strata situations than for rental.
•Suggestion of going through the operator/building manager as the delivery agent for the installs.
•Issues with showerheads are largely the same as for aerators.
•Some experience with strata corporations on a fireplace program has been quite positive. Some strata corporations can be a barrier, but some are quite activist on these issues.
•Can also work with the management companies that manage strata buildings on behalf of their corporations.

Notes:
• BCH program has seen increased uptake in recent years, potential for partnership
• Lack of capacity is a barrier (esp. designers)
• Architects, builders inherently conservative.
• Will owner/purchaser/builder occupy?
• Very little demand from consumers. Talk outpacing action.
• Impending hydro rate hikes may drive EE construction (and/or consumer awareness). Especially true in MURBs
• Perception that "green" = more expensive
• Governments quite active despite lack of public uptake (subject to any changes in government/policy environment)
• Significant pushback re: "patchwork" of improved code requirements
• Carbon tax, municipal commitments to carbon neutrality are drivers
• Public sector, Universities etc. building more efficient buildings, but few of them
• Market leaders could bring along the rest of the market. (May have to overpay leaders an underpay followers)
• EE design/build tends to be more time consuming
• Establishment of 3rd party ID labs could overcome many barriers
• Developers tend to lack marketing money, may be a role for TG.
• Dependent on "energy literacy" among consumers.
• Possible partnership with governments: joint incentive, reduction in permitting time (i.e.. fund a staff position to review green permits).

Exhibit 72 Commercial Achievable Worksheet, Opportunity 2

Commercial Sector
C2 -- Roof Insulation

General Measure Information				
Approximate Economic Savings Potential (GJ/yr) in 2030	Space Heating - Roof Insulation	758,000		
Benefit/Cost ratio	Roof insulation	1.2	Incremental	
Approx. payback (years)	Roof insulation	6.2		
Sub Sector for Discussion: Roof insulation > Medium Office > Existing > IN/IS/VI				
Measure information	Benefit/Cost Ratio	1.2	Incremental Cost	
	Approx. Payback (years)	6.2		
Approximate Economic Savings Potential (GJ/yr) in 2015		5,400		
Approximate Economic Savings Potential (GJ/yr) in 2030		20,700		
Market Size	Total ft^2 (approx.)	7,831,858		
	Total # of sites (estimated)	110	Eq. 75,000 ft^2 buildings	
	% eligible	90%	Exclude "can't" + current	
	# eligible sites by 2010 - 2015	25		
	# eligible sites 2025 - 2030	25		
Participation Rates, by Year (% of Eligible Sites)		**2011-2015**	**2026-2030**	**Curve**
Roof insulation	Common Sense	3%	40%	Curve B
	Aggressive	4%	70%	Curve B
Achievable Potential (# Buildings)				
Roof insulation	Common Sense	1	10	
	Aggressive	1	18	

Participation Rates for Other Subsectors/Regions (H=higher; L=lower; S=same; N/A=not applicable)			
Large Office	Higher	Hospital	Higher
Medium Office		Nursing Home	Higher
Large Non-food Retail	Higher	Large School	Higher
Medium Non-food Retail	Same	Medium School	Higher
Food Retail	Same	University/College	Higher
Large Hotel	Higher	Large Apartment	Same
Medium Hotel	Same	Medium Apartment	Same
Restaurant	Same		
Warehouse/Wholesale	Same	Vancouver Island	
		Inland North	
		Inland South	

Program Implementation Considerations		
Sensitivity to Incentives	(High Medium Low)	
Primary Incentive Target	(User, Channel Member, Both)	
Sensitivity to Direct Program Support	(High Medium Low)	
Most Critical Program Support Type(s)	(e.g., Trade Ally Training, Certification, Technical Workshops, etc.)	

Notes:
•TG generally has to offer programs throughout the service territory. They can't really offer a program to three regions and exclude the Lower Mainland. Need to check on what the weighted average TRC result is.
•Need to pursue this through relationships with roofers, which TG doesn't currently have. That will require some start-up.
•Need to consider a barrier to do with rooftop equipment and required clearances.
•Need to do it when roof membrane being replaced in most cases.
•Interior may be a bit more difficult than LM/VI.

Exhibit 73 Commercial Achievable Worksheet, Opportunity 3

Commercial Sector
C3 -- Condensing DHW Tanks

General Measure Information				
Approximate Economic Savings Potential (GJ/yr) in 2030	Condensing DHW Tank	467,000		
Benefit/Cost ratio	Condensing DHW Tank	1.7	Incremental	
Approx. payback (years)	Condensing DHW Tank	3.6		
Sub Sector for Discussion: Condensing DHW Boilers > Large Apartment > Existing > Lower Mainland				
Measure information	Benefit/Cost Ratio	2.6	Incremental Cost	
	Approx. Payback (years)	2.4		
Approximate Economic Savings Potential (GJ/yr) in 2015		54,100		
Approximate Economic Savings Potential (GJ/yr) in 2030		143,500		
Market Size	Total ft^2 (approx.)	165,932,658		
	Total # of sites (estimated)	720	Eq. 230,000 ft^2 buildings	
	% eligible	30%	Exclude "can't", N/A + current	
	# eligible sites 2010 - 2015	73		
	# eligible sites 2025 - 2030	73		
Participation Rates, by Year (% of Eligible Sites)		**2011-2015**	**2026-2030**	**Curve**
Condensing DHW Boilers	Common Sense	3%	40%	Curve B
	Aggressive	5%	75%	Curve B
Achievable Potential (# Buildings)				
Condensing DHW Boilers	Common Sense	2	29	
	Aggressive	3	55	

Participation Rates for Other Subsectors/Regions (H=higher; L=lower; S=same; N/A=not applicable)			
Large Office	Lower	Hospital	Higher
Medium Office	Lower	Nursing Home	Higher
Large Non-food Retail	Lower	Large School	Higher
Medium Non-food Retail	Lower	Medium School	Higher
Food Retail	Lower	University/College	Higher
Large Hotel	Higher	Large Apartment	
Medium Hotel	Higher	Medium Apartment	Same
Restaurant	Higher		
Warehouse/Wholesale		Vancouver Island	Slightly higher
		Inland North	Same
		Inland South	Same

Program Implementation Considerations		
Sensitivity to Incentives	(High Medium Low)	
Primary Incentive Target	(User, Channel Member, Both)	
Sensitivity to Direct Program Support	(High Medium Low)	
Most Critical Program Support Type(s)	(e.g., Trade Ally Training, Certification, Technical Workshops, etc.)	

Notes:
•Venting is one of the challenges. Some buildings have B-venting through the roof, but mainly that's in 3-4 storey buildings. In high rise, the tanks are likely either in a rooftop mechanical room or a basement. Venting is probably not a big problem there. There currently isn't an option for common venting. If they already have B-vented standard tank type heaters, the vents may be ganged together. You can't do that with the condensing type.
•Cost issues around run length of PVC pipe as well as the type of plastic you are allowed to use. If the exhaust is hotter, the venting material costs four times as much.
•Apartment owner's main concern is reliability. They don't want call-backs on water heater failure.
•Incremental cost can be overcome if the savings are demonstrable and they can be assured of reliability. If they can't, no incentive will overcome the reluctance.
•There are still a lot of contractors who are sceptical of reliability of condensing units. Certainly the condensing tank is more complex and has more parts, and the servicing people are not all knowledgeable enough to service the product properly. The technology is now mature enough that reliability issues have been resolved.
•Partnerships for developing training programs for contractors would be appropriate.
•Typically the target market is going to be the strata corporations.
•Apartment building owners are hard to convince on spending more money upfront. Sometimes they are holding the building mainly because of the appreciating land value, so they're not interested in a lot of investment.
•A lot of strata corporation boards would have very little technical knowledge and might be hard to convince. This amount of expenditure is also probably voted on by the AGM, not just the board.
•The technology is relatively new: 10-12 years into it with water heaters.
•Could the program include provisions for regular servicing of the equipment? Could also have internet connection to the product to do remote monitoring. People who work on condensing boilers could easily take on servicing of condensing DHW tanks, but regular plumbing contractors would not be as far along the learning curve.
•Payback threshold is probably 2-3 years in this subsector.
•Higher cost of servicing the equipment is also a perceptual barrier out there.
•Awareness and availability of product are also issues. They don't have enough track record with their new product to have a sense of how it will go yet. Program was only launched in July.
•By 2020, current proposal is that this efficiency becomes minimum under federal legislation.
•Conversation would be very similar for tankless condensing.

Exhibit 74 Commercial Achievable Worksheet, Opportunity 4

Commercial Sector

C4 -- HE Cooking Equipment

General Measure Information				
Approximate Economic Savings Potential (GJ/yr) in 2030	HE Cooking Equipment	578,000		
Benefit/Cost ratio	HE Cooking Equipment	1.5	Incremental	
Approx. payback (years)	HE Cooking Equipment	3.1		
Sub Sector for Discussion: HE Cooking > Restaurant > Existing > Lower Mainland				
Measure information	Benefit/Cost Ratio	1.8	Incremental Cost	
	Approx. Payback (years)	2.6		
Approximate Economic Savings Potential (GJ/yr) in 2015		185,300		
Approximate Economic Savings Potential (GJ/yr) in 2030		370,700		
Market Size	Total ft^2 (approx.)	18,725,522		
	Total # of sites (estimated)	4,300	Eq. 3,300 ft^2 buildings	
	% eligible	80%	Exclude "can't" + current	
	# eligible sites 2010 - 2015	1,700		
	# eligible sites 2025 - 2030	1,700		
Participation Rates, by Year (% of Eligible Sites)		**2011-2015**	**2026-2030**	**Curve**
HE Cooking Equipment	Common Sense	3%	45%	Curve B
	Aggressive	4%	70%	Curve B
Achievable Potential (# Buildings)				
HE Cooking Equipment	Common Sense	48	765	
	Aggressive	74	1190	

Participation Rates for Other Subsectors/Regions (H=higher; L=lower; S=same; N/A=not applicable)			
Large Office		Hospital	Higher
Medium Office		Nursing Home	Higher
Large Non-food Retail		Large School	Higher
Medium Non-food Retail		Medium School	Higher
Food Retail		University/College	Higher
Large Hotel		Large Apartment	
Medium Hotel		Medium Apartment	
Restaurant			
Warehouse/Wholesale		Vancouver Island	Same
		Inland North	Slightly lower
		Inland South	Same

Program Implementation Considerations		
Sensitivity to Incentives	(High Medium Low)	
Primary Incentive Target	(User, Channel Member, Both)	
Sensitivity to Direct Program Support	(High Medium Low)	
Most Critical Program Support Type(s)	(e.g., Trade Ally Training, Certification, Technical Workshops, etc.)	

Notes:
•Lot of turnover in the restaurant business.
•Market leaders exist in some of the chains.
•Chains vary by corporate culture. Some are very slow adopters, others quite enthusiastic.
•Quality of the product is an issue with some equipment and chains.
•Program through equipment vendors might work well, particularly if the incremental cost can be covered.
•Some experience offering boiler programs to restaurants suggests that when the participate in that program they are looking for high efficiency cooking equipment as well.
•Lower Mainland might be a bit higher because of trend towards cooking under the public eye (in front).

Exhibit 75 Commercial Achievable Worksheet, Opportunity 5

Commercial Sector
C5 -- HE Boilers

General Measure Information				
Approximate Economic Savings Potential (GJ/yr) in 2030	HE Boilers	1,050,000		
Benefit/Cost ratio	Condensing Near Condensing	1.8 6.4	Incremental, @ 1000 FLE Hours	
Approx. payback (years)	Condensing Near Condensing	4.7 1.3		
Sub Sector for Discussion: HE Boilers > Large Office > Existing > Lower Mainland				
Measure information	Benefit/Cost Ratio Approx. Payback (years)	1.8, 6.4 4.7, 1.3	Incremental, @ 1000 FLE Hours	
Approximate Economic Savings Potential (GJ/yr) in 2015		185,300		
Approximate Economic Savings Potential (GJ/yr) in 2030		370,700		
Market Size	Total ft^2 (approx.) Total # of sites (estimated) % eligible # eligible sites 2010 - 2015 # eligible sites 2025 - 2030	30,704,593 100 72% 20 20	Eq. 230,000 ft^2 buildings Exclude "can't", N/A, + current	
Participation Rates, by Year (% of Eligible Sites)		**2011-2015**	**2026-2030**	**Curve**
Condensing	Common Sense	10%	39%	Curve A
	Aggressive	14%	54%	Curve A
Remaining	Common Sense	18	12	
	Aggressive	17	9	
Near Condensing	Common Sense	10%	41%	Curve A
	Aggressive	19%	76%	Curve A
Achievable Potential (# Buildings)				
Condensing	Common Sense	2	8	
	Aggressive	3	11	
Near Condensing	Common Sense	2	5	
	Aggressive	3	7	
Total	Common Sense	4	13	
	Aggressive	6	18	

Participation Rates for Other Subsectors/Regions (H=higher; L=lower; S=same; N/A=not applicable)			
Large Office		Hospital	Higher
Medium Office	Same	Nursing Home	Higher
Large Non-food Retail		Large School	Higher
Medium Non-food Retail		Medium School	Higher
Food Retail		University/College	Higher
Large Hotel	Higher	Large Apartment	Lower
Medium Hotel	Lower	Medium Apartment	Lower
Restaurant	Not really applicable		
Warehouse/Wholesale	Not really applicable	Vancouver Island	Same
		Inland North	Higher
		Inland South	Higher

Program Implementation Considerations		
Sensitivity to Incentives	(High Medium Low)	
Primary Incentive Target	(User, Channel Member, Both)	
Sensitivity to Direct Program Support	(High Medium Low)	
Most Critical Program Support Type(s)	(e.g., Trade Ally Training, Certification, Technical Workshops, etc.)	

Notes:
•Boiler program experience starting to come in.
•There are owners who put in hybrid systems - put in some condensing units, but keep the old one as a peaking unit.
•Earlier on there were contractors who thought the program was foolish because of reliability concerns.
•Now there are lots more advanced contractors who are comfortable with the condensing technology.
•There are lots of installations now where the system design is correct so that you get condensing, but there are still installers who don't know how to do that properly.
•The mild climate means there are lots of periods of the year that are like "shoulder seasons" so that it's possible to use relatively low delivery and return temperatures to ensure condensing occurs.
•Boiler program is going to be segmented by several different building types and by boiler efficiency.
•This technology is heading towards becoming the norm - there are still issues with the industry, but it is coming along.
•Incremental cost doesn't seem to be a huge issue.
•Most of the program experience has been with large institutional, where most owners seem convinced that this is the thing to do, and with large apartment owners, who are pretty convinced that it isn't the thing to do.

Exhibit 76 Commercial Achievable Worksheet, Opportunity 6

Commercial Sector
C6 -- Recommissioning

General Measure Information				
Approximate Economic Savings Potential (GJ/yr) in 2030	RCx and Advanced BAS	690,000		
Benefit/Cost ratio		3.7		
Approx. payback (years)		1.7		
Sub Sector for Discussion: Recommissioning> Large Office > Existing > Lower Mainland				
Measure information	Benefit/Cost Ratio	3.7		
	Approx. Payback (years)	1.7		
Approximate Economic Savings Potential (GJ/yr) in 2015		36,000		
Approximate Economic Savings Potential (GJ/yr) in 2030		33,600		
Market Size	Total ft^2 (approx.)	30,704,593		
	Total # of sites (estimated)	100	Eq. 230,000 ft^2 buildings	
	% eligible	95%	Exclude "can't", N/A, + current	
	# eligible sites by 2015	130		
	# eligible sites by 2030	130		
Participation Rates, by Year (% of Eligible Sites)		**2015**	**2030**	**Curve**
Recommissioning	Common Sense		80%	**Curve A**
	Aggressive		100%	Curve A
Achievable Potential (# Buildings)				
Recommissioning	Common Sense	0	104	
	Aggressive	0	130	

Participation Rates for Other Subsectors/Regions (H=higher; L=lower; S=same; N/A=not applicable)			
Large Office		Hospital	Higher
Medium Office	Same	Nursing Home	Higher
Large Non-food Retail	Same	Large School	Higher
Medium Non-food Retail	Lower	Medium School	Higher
Food Retail	Same	University/College	Higher
Large Hotel	Same	Large Apartment	Lower
Medium Hotel	Lower	Medium Apartment	Lower
Restaurant	Same		
Warehouse/Wholesale	Same	Vancouver Island	same
		Inland North	same
		Inland South	same

Program Implementation Considerations		
Sensitivity to Incentives	(High Medium Low)	
Primary Incentive Target	(User, Channel Member, Both)	
Sensitivity to Direct Program Support	(High Medium Low)	
Most Critical Program Support Type(s)	(e.g., Trade Ally Training, Certification, Technical Workshops, etc.)	

Notes:
Commissioning can mean different things to different contractors

benefits & payback clear, but market knowledge is low.

Perception is that not always necessary (by owners) - no immediate incentive/crisis

Site assessment program could be used to determine opportunity for RCx

Overall lack of understanding awareness re: degree of rigor, benefits not always apparent.

May be lack of capacity in the market to deliver service

BCH/Terasen partnership: in discussion.

Current energy specialist program - individuals may be able to promote RCx within organizations.

Split incentives an issue. Leased buildings may be less likely to participate.

Exhibit 77 Commercial Achievable Worksheet, Opportunity 7

Commercial Sector
C7 -- O&M Measures

General Measure Information			
Approximate Economic Savings Potential (GJ/yr) in 2030	O&M Measures	1,020,000	
Benefit/Cost ratio		1.9	
Approx. payback (months)		3	

Sub Sector for Discussion: O&M Measures > Large Office > Existing > Lower Mainland				
Measure information	Benefit/Cost Ratio	1.9		
	Approx. Payback (months)	3.0		
Approximate Economic Savings Potential (GJ/yr) in 2015		35,500		
Approximate Economic Savings Potential (GJ/yr) in 2030		33,200		
Market Size	Total ft^2 (approx.)	30,704,593		
	Total # of sites (estimated)	100	Eq. 230,000 ft^2 buildings	
	% eligible	80%	Exclude "can't", N/A, + current	
	# eligible sites by 2015	110		
	# eligible sites by 2030	110		
Participation Rates, by Year (% of Eligible Sites)		**2015**	**2030**	**Curve**
O&M Measures	Common Sense		75%	**Curve B**
	Aggressive		90%	Curve A
Achievable Potential (# Buildings)				
O&M Measures	Common Sense	0	83	
	Aggressive	0	99	

Participation Rates for Other Subsectors/Regions (H=higher; L=lower; S=same; N/A=not applicable)			
Large Office		Hospital	same
Medium Office	same	Nursing Home	same
Large Non-food Retail	same	Large School	same
Medium Non-food Retail	same	Medium School	same
Food Retail	same	University/College	same
Large Hotel	same	Large Apartment	same
Medium Hotel	same	Medium Apartment	same
Restaurant	same		
Warehouse/Wholesale	same	Vancouver Island	same
		Inland North	same
		Inland South	same

Program Implementation Considerations		
Sensitivity to Incentives	(High Medium Low)	
Primary Incentive Target	(User, Channel Member, Both)	
Sensitivity to Direct Program Support	(High Medium Low)	
Most Critical Program Support Type(s)	(e.g., Trade Ally Training, Certification, Technical Workshops, etc.)	

Notes:
•most buildings in the CEUS & other walk-through audits show potential savings. Visible problems dealt with most often.
•Most building maintenance staff feel that appropriate maintenance is being undertaken.
•Could this be tied to on site assessments?
•Mobility among building maintenance staff is a barrier
•May fund a building maintenance manual / checklist (specific to each building)
• Fewer on site building engineers, often outsourced to contractors
•May be a larger opportunity in smaller commercial buildings (when unqualified staff are responsible for maintenance)
• Opportunity to educate contractors (& their associations)
•May be an opportunity for contractors to "up-sell" by looking for other issues while on a call.
• May be possibility that contractors undertake unnecessary measures if incented to do so.

Exhibit 78 Commercial Achievable Worksheet, Opportunity 8

Commercial Sector
C8 -- Advanced New Construction Measures

General Measure Information				
Approximate Economic Savings Potential (GJ/yr) in 2030	New Construction - 40% Better	450,000		
Benefit/Cost ratio	40% Better 25% Better	3.0 5.7		
Approx. payback (years)	40% Better 25% Better	6.4 3.4		
Sub Sector for Discussion: New Construction > All Subsectors > Existing > Lower Mainland				
Measure information	Benefit/Cost Ratio Approx. Payback (years)	3.0, 5.7 6.4, 3.5		
Approximate Economic Savings Potential (GJ/yr) in 2015		106,000		
Approximate Economic Savings Potential (GJ/yr) in 2030		347,000		
Market Size	Total ft^2 (approx, to 2015)	17,883,465		
	Total # of sites (estimated)	180	Eq. 100,000 ft^2 buildings	
	% eligible	100%		
	# eligible sites by 2010 - 2015	180		
	# eligible sites 2025 - 2030	130		
Participation Rates, by Year (% of Eligible Sites)		**2011-2015**	**2026-2030**	**Curve**
40% Better	Common Sense	2%	25%	**Curve B**
	Aggressive	10%	40%	Curve A
Remaining	Common Sense	177	98	
	Aggressive	162	78	
25% Better	Common Sense	0%	45%	
	Aggressive	0%	50%	
Achievable Potential (# Buildings)				
40% Better	Common Sense	3	33	
	Aggressive	18	52	
25% Better	Common Sense	0	44	
	Aggressive	0	39	
Total	Common Sense	3	76	
	Aggressive	18	91	

Participation Rates for Other Subsectors/Regions (H=higher; L=lower; S=same; N/A=not applicable)

Large Office	Same	Hospital	Higher
Medium Office	Same	Nursing Home	Higher
Large Non-food Retail	Same	Large School	Higher
Medium Non-food Retail	Lower	Medium School	Higher
Food Retail	Same	University/College	Higher
Large Hotel	Same	Large Apartment	Same
Medium Hotel	Lower	Medium Apartment	Lower
Restaurant	Lower		
Warehouse/Wholesale		Vancouver Island	Same
		Inland North	Same
		Inland South	Same

Program Implementation Considerations

Sensitivity to Incentives	(High Medium Low)	
Primary Incentive Target	(User, Channel Member, Both)	
Sensitivity to Direct Program Support	(High Medium Low)	
Most Critical Program Support Type(s)	(e.g., Trade Ally Training, Certification, Technical Workshops, etc.)	

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CONSERVATION POTENTIAL REVIEW FORTISBC

Industrial Sector

Energy-efficiency & Alternative Energy Opportunities

Final Report

Submitted to
FortisBC

Submitted by
ICF Marbek
Willis Energy Services

April 28, 2011

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Executive Summary

Background and Objectives

This Conservation Potential Review (CPR) provides FortisBC Energy Utilities ("FortisBC") with a comprehensive planning document that the company can use on an ongoing basis to:

- Develop a long-range energy-efficiency strategy
- Design and implement energy-efficiency programs
- Assess the impact of energy-efficiency programs on both peak and annual loads
- Set annual energy-efficiency targets and budgets.

Scope

Sector Coverage: The study addresses three sectors: Residential, Commercial/Institutional[1] and Industrial. In contrast to the 2006 CPR, which excluded FortisBC's (then, Terasen Gas) 300 largest industrial accounts, this CPR includes all of FortisBC's customers.

Geographical Coverage: The study results are presented for the total FortisBC service region and for the five service areas of: Lower Mainland, Vancouver Island, Whistler, Northern Interior and Southern Interior.

Study Period: The Base Year for this study is calendar year 2010. The time period covered by this study is to 2030, with milestones at the intervening years of 2015, 2020 and 2025.

Technologies: The study addresses energy-efficiency, customer behaviour and alternative energy options such as renewable and combined heat and power technologies.

Relation to Previous B.C. CPRs: This study builds on the substantial body of information and modeling work prepared in previous CPR studies conducted for FortisBC (then Terasen Gas) (2006) and BC Hydro (2007). The 2006 FortisBC study was intended to mesh with the BC Hydro study from 2007 and therefore included all customers of either utility, not just FortisBC customers. This study includes only FortisBC natural gas customers because this permitted the study to make better use of the recently completed energy end-use studies.

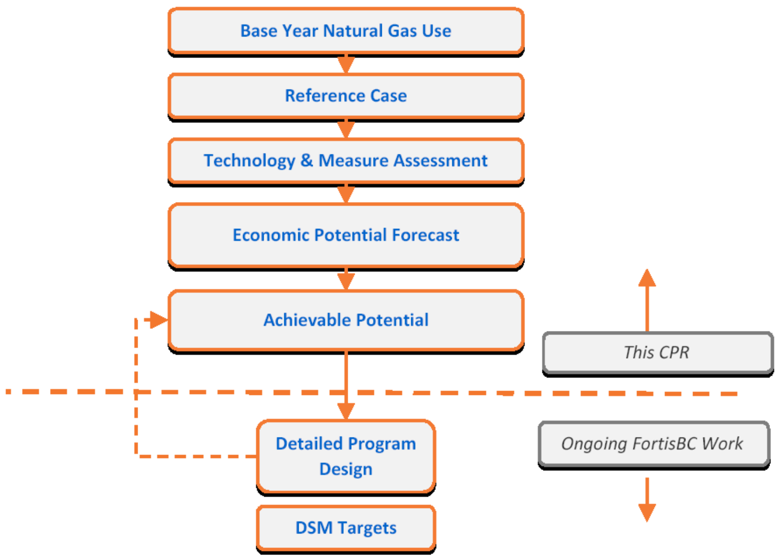
Approach

The detailed end-use analysis of energy-efficiency opportunities in the Industrial sector employed a customized spreadsheet model. Key inputs to the model were the forecast of comfort and process heat requirements per service area, major sub sector, and major end use. Other key inputs were the efficiency of the technologies (natural gas-using equipment) that were currently in place and the efficiency of higher efficiency alternatives that were available.

The major steps involved in the analysis are shown in Exhibit ES 1 and are discussed in Section 2 of this report. As illustrated, the results of this CPR study, and in particular the estimation of Achievable Potential, support on-going DSM planning work. However, it should be emphasized that the estimation of Achievable Potential is not synonymous with either the setting of specific program targets or with program design.

[1] Throughout this report, use of the word "commercial" includes both commercial and institutional buildings unless otherwise noted.

Exhibit ES 1 CPR 2010: Main Analytic Steps



Base Year Natural Gas Use

In the Base Year of 2010, FortisBC's industrial customers consumed approximately 36,456,000 GJ. Exhibit ES 2 and Exhibit ES 3 provide, respectively, additional details on the major end uses and sub sectors where Industrial sector natural gas consumption occurs.

Exhibit ES 2 shows that boilers accounts for approximately 43% of the total industrial natural gas use. Most of the boiler load involves process steam use. Furnaces for air heating large industrial areas account for about 12% of the consumption and another 12% is used in kilns at pulp and paper sites, manufacturing lime for the Kraft pulping process. The remaining natural gas is used in a variety of industrial processes including lumber kilns, coal driers and cement kilns.

Exhibit ES 2 Base Year 2010 – Industrial Natural Gas Consumption by Major End Use – All Service Areas

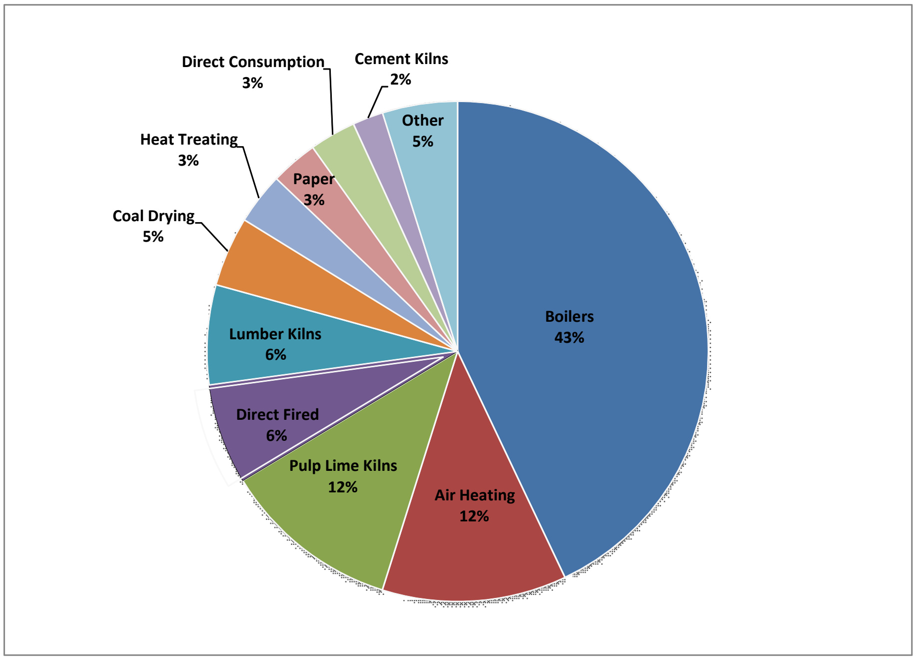
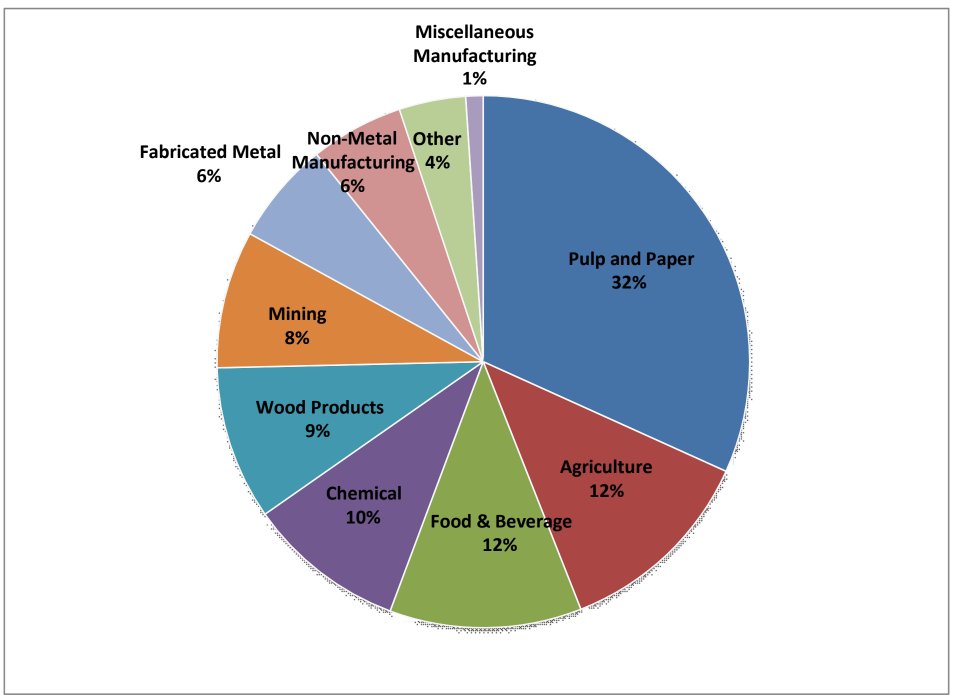


Exhibit ES 3 indicates the distribution among the sub sectors. The Pulp and Paper sector dominates at 32%, followed by Agriculture, Food & Beverage at 12% each, Chemical at 10%, Wood Products at 9%, Mining at 8% and Fabricated Metal at 6%.

Exhibit ES 3 Base Year Industrial Natural Gas Consumption Distribution of Use by Sub Sector

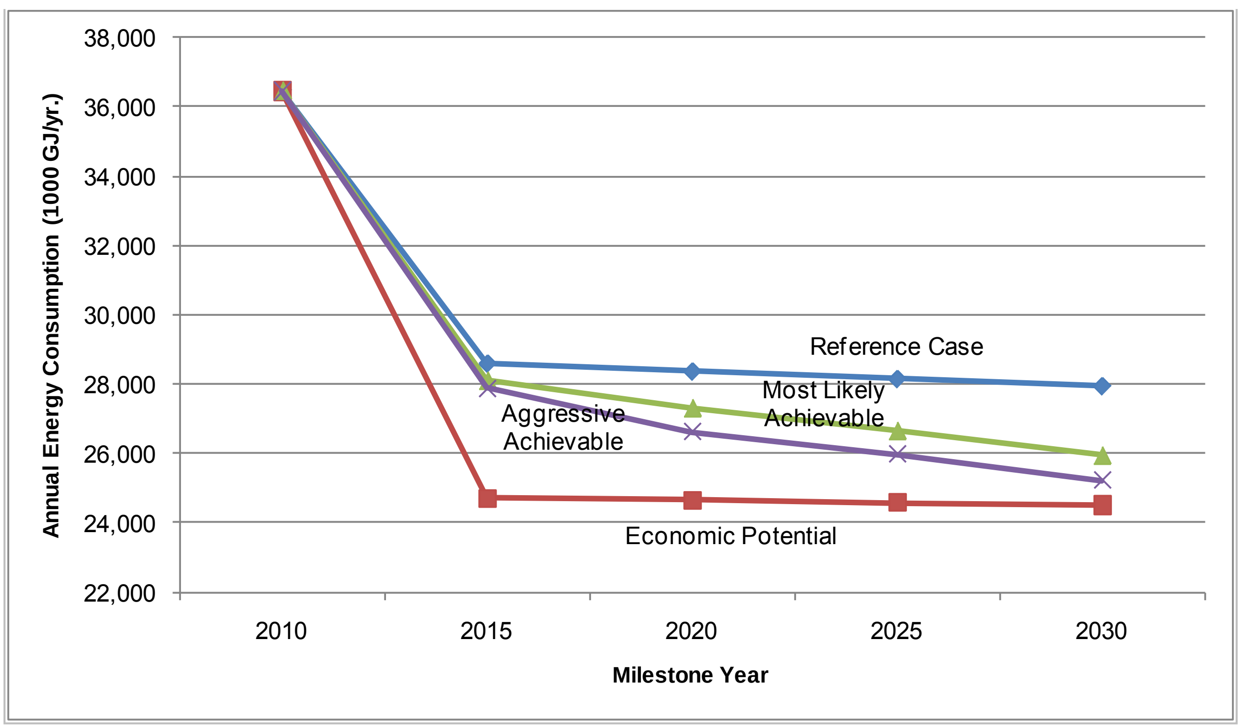


Results and Findings

A summary of the levels of annual natural gas consumption contained in the Reference Case and each of the energy-efficiency forecasts, by milestone year, is presented in Exhibit ES 4 and discussed briefly in the paragraphs below.

Exhibit ES 4 Summary of Forecast Results, Energy Efficiency (TJ/yr.)

Year	Annual Consumption (TJ/yr.)					Potential Annual Savings		
				Achievable			Achievable	
	Base Year	Reference	Economic	Most Likely	Aggressive	Economic	Most Likely	Aggressive
2010	36,456	36,456						
2015		28,594	24,710	28,095	27,880	3,884	500	714
2020		28,367	24,648	27,302	26,621	3,719	1,065	1,747
2025		28,151	24,576	26,646	25,985	3,575	1,505	2,166
2030		27,946	24,506	25,936	25,221	3,439	2,010	2,725



Reference Case

In the absence of continued demand side management (DSM) initiatives, the study estimates that natural gas consumption in the Industrial sector will decline from the Base Year (2010) consumption of approximately 36,546,000 GJ/yr. to 28,367,000 GJ/yr. by 2020 and 27,946,000 GJ/yr. by 2030. This represents an overall decrease of about 23% in the period. The forecast decrease is due to an expected continued decline in the wood products and pulp and paper industry as well as a continuation of the move to wood waste from natural gas. The move to wood waste will be mainly due to the provincial government policy of encouraging a reduction of GHG emissions.

Economic Potential Forecast

Under the conditions of the Economic Potential Forecast, the study estimated that consumption in the Industrial sector would decline to about 24,506,000 GJ/yr. by 2030. Annual savings relative to the Reference Case are about 3,439,000 GJ/yr. or about 12%. The Economic Potential is obtained relatively quickly due to the analysis indicating that, from a strictly economic perspective, most of the inefficient equipment could be replaced by more efficient alternatives within the next five years.

Achievable Potential – Energy-efficiency Scenario

A selection of the natural gas savings opportunities identified in the Economic Potential Forecast was discussed in a full-day workshop. The guided participant discussions provided estimated levels of participation under a *most likely* scenario of program activity and an *aggressive* scenario of program activity. These levels were applied to the Economic Potential savings to estimate the Achievable Potential for these two scenarios. For technologies not specifically discussed in the workshops, participation levels were estimated through extrapolation from the technologies that were discussed. The results are presented in Exhibit ES 5 and Exhibit ES 6 by technology and by milestone year for, respectively, the *most likely* and *aggressive* Achievable Potential scenarios.

Exhibit ES 5 Most Likely Achievable Natural Gas Savings for the Total FortisBC Service Area by Technology and Milestone Year (GJ/yr.)

Technology	2015	2020	2025	2030	2030 Savings Share of 2030 Reference Consumption	2030 Savings Share of Total 2030 Savings
Boilers	256,269	527,267	823,065	1,153,094	9%	57%
Air Heating	88,567	174,994	259,343	341,709	11%	17%
Ovens	470	4,134	6,278	8,748	1%	0%
Heat Treating	1,809	16,439	23,073	29,753	6%	1%
Lumber Kilns	48,534	97,260	140,724	180,165	29%	9%
Veneer Dryers	6,116	12,044	17,723	23,097	1%	1%
Pulp Lime Kilns	2,884	8,117	15,777	25,538	6%	1%
Cement Kilns	6,395	13,015	17,758	21,494	3%	1%
Ore Drying	1,016	2,435	2,639	2,964	0%	0%
Coal Drying	53,356	127,832	110,862	124,497	24%	6%
Direct Fired	34,172	81,391	88,010	98,928	6%	5%
Total	499,589	1,064,929	1,505,251	2,009,988	7%	100%

Exhibit ES 6 Aggressive Achievable Natural Gas Savings for the Total FortisBC Service Area by Technology and Milestone Year (GJ/yr.)

End Use	Technology	2015	2020	2025	2030	2030 Savings Share of Total 2030 Savings	Average B/C Ratio
Coal and Ore Drying	High-efficiency Coal and Ore Dryers	55,388	132,701	116,140	130,425	5%	15 (Coal)
Cement Kilns	High-efficiency Kiln	2,558	23,427	33,149	42,988	2%	9.1
Pulp Lime Kiln	High-efficiency Kiln	7,211	20,293	39,441	63,846	2%	7.0
Direct Fired	Direct-fired Heating- Gypsum and Asphalt	68,344	162,783	176,021	197,856	7%	5.5
Ovens	High-efficiency Ovens	940	8,268	12,555	17,497	1%	5.4
Heat Treating	Heat Treating Furnace with Sequential Firing, High-velocity Burners	3,619	32,879	46,145	59,507	2%	5.4
Veneer Dryers	Advanced Veneer Dryer	9,785	19,271	28,357	36,955	1%	5.4
Air Heating	Radiant Tube Heating	110,709	218,743	324,178	427,137	16%	4.4
Lumber Kiln	High-efficiency Kiln	64,712	129,680	187,632	240,220	9%	4.2
Boilers	Efficient Boilers	373,963	950,508	1,110,661	1,367,177	50%	~4
Process Water Heating	Direct-fired Water Heating	7,988	24,561	50,261	81,010	3%	
Paper Drying	Direct-fired Paper Drying	8,871	23,500	41,621	60,576	2%	
	Total	714,089	1,746,613	2,166,162	2,725,193	100%	

Peak Day Load Impacts – Energy-efficiency Scenarios

The peak day savings associated with each of the Achievable energy-efficiency scenarios were calculated using load factor data provided by FortisBC. The results are summarized in Exhibit ES 7 and Exhibit ES 8. As illustrated, the Achievable peak day savings in 2030 range from a decrease of 16,990 GJ/day (*most likely* scenario) to a decrease of 23,080 GJ/day (*aggressive* scenario) for the total FortisBC service region.

Exhibit ES 7 Peak Day Capacity Impacts – Most likely Achievable Potential, by Scenario, Service Region and Milestone Year (GJ)

Year	Lower Mainland	Northern Interior	Southern Interior	Vancouver Island	Grand Total
2015	2,197	936	971	110	4,213
2020	4,633	1,963	2,150	227	8,973
2025	6,749	2,978	2,659	328	12,715
2030	9,055	4,064	3,462	409	16,990

Exhibit ES 8 Peak Day Capacity Impacts – Aggressive Achievable Potential, by Scenario, Service Region and Milestone Year (GJ)

Year	Lower Mainland	Northern Interior	Southern Interior	Vancouver Island	Grand Total
2015	3,250	1,398	1,228	162	6,039
2020	8,064	3,367	2,990	373	14,794
2025	10,003	4,424	3,442	476	18,346
2030	12,544	5,694	4,285	556	23,080

Greenhouse Gas Impacts – Energy-efficiency Scenarios

The natural gas savings associated with each of the Achievable Potential scenarios would also result in a reduction of greenhouse gas (GHG) emissions.[2] As illustrated in Exhibit ES 9 and Exhibit ES 10, by 2030 the GHG reductions are estimated to be in the range of 96,000 to 130,000 tonnes CO_2e per year, depending on scenario.

Exhibit ES 9 Estimated GHG Emission Reductions – Most likely Achievable Potential, By Scenario and Milestone Year (tonnes CO_2e/yr.)

Year	Lower Mainland	Northern Interior	Southern Interior	Vancouver Island	Grand Total
2015	3,250	1,398	1,228	162	6,039
2020	8,064	3,367	2,990	373	14,794
2025	10,003	4,424	3,442	476	18,346
2030	12,544	5,694	4,285	556	23,080

Exhibit ES 10 Estimated GHG Emission Reductions – Aggressive Achievable Potential, By Scenario and Milestone Year (tonnes CO_2e/yr.)

Year	Lower Mainland	Northern Interior	Southern Interior	Vancouver Island	Grand Total
2015	16,809	8,681	7,627	1,159	34,276
2020	41,707	20,903	18,563	2,665	83,837
2025	51,735	27,468	21,374	3,399	103,976
2030	64,876	35,357	26,607	3,969	130,809

[2] GHG impacts are estimated based on an emissions factor of 48 kg of CO_2 e per GJ of natural gas. This is the BC natural gas emissions factor.

Summary of Findings

The study findings indicated that even with a declining load growth there are significant potential cost-effective natural gas efficiency improvements in the Industrial sector. This potential is due to the existence of older inefficient boilers, lumber kilns, lime kilns, and a variety of other industrial process equipment that could be economically replaced. It would be cost effective for this replacement to occur by 2015, but due to other market barriers, it is estimated that in the most likely and aggressive scenarios it will take until 2030 to obtain the savings.

The major barriers constraining faster market penetration include:

- High equipment and installation cost of efficient technologies
- Need to recover investment costs in a short period (payback)
- Lack of product performance information
- Lack of available product.

In the most likely and aggressive Achievable scenarios those energy-efficiency improvements would provide between 2,010,000 and 2,725,000 GJ/yr. of savings in 2030 as well as peak day load reductions of approximately 16,990 to 23,080 GJ.

A variety of efficient boiler technologies account for nearly 57% of the total energy savings in the two Achievable Potential scenarios. The major opportunity involves replacing standard efficiency boilers in the 68-80% efficiency range with condensing boilers in the plus 90% efficiency range. This opportunity is mainly applicable to medium size boilers in the food processing and manufacturing sectors.

For large boilers, such as in pulp mills, and for large process equipment such as cement kilns, lime kilns and coal driers, the most likely opportunities will involve upgrading the equipment with better controls or heat recovery equipment rather than replacing the complete unit. The cost of replacing complete units will usually involve large capital expenditures (often more than $100 million) and there were no sites where it appeared that this type of expenditure could be justified on the basis of simply reducing natural gas use.

Improving the air heating efficiency of large industrial fabrication workspaces is another significant energy saving opportunity. Generally, these spaces are now heated with unit heaters. In some cases, inefficient unit heaters could be replaced with more efficient unit heaters but replacing the unit heaters with gas radiant heaters is a larger opportunity.

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APPENDICES (Bound separately)

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1 Introduction

1.1 Background and Objectives

This Conservation Potential Review (CPR) provides FortisBC with a comprehensive planning document that the company can use on an ongoing basis to inform the:

- Development of a long range energy-efficiency and fuel choice strategy
- Design and development of energy-efficiency and fuel choice programs
- Assessment of the impact of energy-efficiency and fuel choice programs on peak versus annual load
- Setting of annual energy-efficiency and fuel choice targets and budgets.

1.2 Study Scope

Sector Coverage: The study addresses three sectors: Residential, Commercial/Institutional and Industrial. In contrast to the 2006 CPR, which excluded FortisBC's 300 largest industrial accounts, this CPR includes all of FortisBC's customers.

Geographical Coverage: The study results are presented for the total FortisBC service region and for the five service areas of: Lower Mainland, Vancouver Island, Whistler, Northern Interior and Southern Interior.

Study Period: The Base Year for this study is calendar year 2010. The time period covered by this study is to 2030, with milestones at the intervening years of 2015, 2020 and 2025.

Technologies: The study addresses energy-efficiency, operations and maintenance (O&M), alternative energy options such as renewable, and combined heat and power technologies.

Relation to Previous B.C. CPRs: This study builds on the substantial body of information and modeling work prepared in previous CPR studies conducted for FortisBC (2006) and BC Hydro (2007). The 2006 FortisBC study was intended to mesh with the BC Hydro study from 2007 and therefore included all customers of either utility, not just FortisBC customers. This study includes only FortisBC natural gas customers because this permitted the study to make better use of the recently completed energy end-use studies.

1.2.1 Data Caveat

As in any study of this type, the results presented in this report are based on a large number of important assumptions. Assumptions such as those related to the current penetration of energy-efficient technologies, the rate of future growth in the economy and specific customer barriers to implementing new energy-efficiency measures. Specific customer barriers include:

- Customer does not have sufficient in-house technical resources to project manage the implementation of projects
- There is uncertainty as to the long-term viability of the operation at the particular site involved
- Customer's technical personnel do not want to risk changing an existing equipment unit that is working reliably even though it is not energy efficient.

Wherever possible, the assumptions used in this study are consistent with those used by FortisBC and are based on best available information, which in many cases includes the professional judgement of the consultant team, FortisBC personnel and local experts. The reader should, therefore, use the results presented in this report as best available estimates; major assumptions, information sources and caveats are noted throughout the report.

1.3 Study Organization

The study has been organized into four[3] areas:

- **Three individual sector reports** (Residential, Commercial and Industrial) that provide an assessment of the technical opportunities for more efficient use of natural gas within each sector.
- **A commercial end-use survey (CEUS)** that provides insight into current natural gas equipment efficiency levels, fuel share and annual consumption levels within key Commercial sub sectors. The CEUS results were used to refine the Commercial sector building archetypes employed in the assessment of technical opportunities.
- **A summary and employment impact report** that brings together the findings of the Residential, Commercial and Industrial sectors, together with an estimate of net job creation and other economic effects attributable to the achievable efficiency activities results within the three sectors.
- **An options paper** that outlines alternative approaches to the assessment of cost-effective levels of DSM activity outside of the California Standard Practice tests.

1.4 This Report

This report presents the Industrial sector results and is organized as follows:

- **Section 2** presents an overview of the study methodology, including a definition of key terms and an outline of the major analytic steps involved.
- **Section 3** presents a profile of Industrial sector Base Year natural gas use in the total FortisBC service area as well as in the five individual service regions.
- **Section 4** presents the Industrial sector Reference Case, which provides a detailed estimate of natural gas use within the total FortisBC service area and each of the five service regions over the study period 2010 to 2030, in the absence of new DSM program initiatives.
- **Section 5** identifies and assesses the economic attractiveness of energy-efficiency, customer behaviour and alternative energy technology options within the Industrial Sector.
- **Section 6** presents the Industrial sector Economic Potential Forecast for the study period 2010 to 2030.
- **Section 7** estimates the proportion of energy savings identified in the Economic Potential Forecast that can realistically be achieved within the study period. Impacts on peak day loads and greenhouse gas emissions are also presented.
- **Section 8** lists sources and references.
- **Section 9** is the Glossary.

[3] A separate Customer Preferences study was prepared in parallel with this CPR. The two studies were, however, implemented in a co-ordinated manner and the results of the Preferences study contributed to the results of this CPR.

1.5 Results Presentation

The preparation of Conservation Potential Reviews involves the compilation and analysis of an enormous amount of market and technology data and a nearly infinite number of ways of organizing and presenting the results. It is recognized that readers will have differing levels of needs with respect to the level of detail that is provided. Consequently, the results of this CPR are presented at three levels of detail.

- **Main report body**. The main body of the report provides a relatively high level reporting of the main steps involved in undertaking each stage the study together with a concise summary of results, including comments and interpretation of key findings. It is assumed that the content and level of detail in the main report body is suitable for the majority of readers who wish to gain an understanding of the potential contribution of DSM options to FortisBC's long-term natural gas requirements.

- **Appendices.** A separate appendix accompanies each major section of the main report. Each appendix provides more detailed information on the methodology employed, including major assumptions or sample calculations as applicable, together with additional levels of results. It is assumed that this presentation is better suited to DSM analysts and managers wishing a more thorough understanding of the study results.

- **Software.** All of the data generated by the study is provided along with the energy end-use and projection model and the Measure TRC model.

  - The energy end-use model for Industrial sector customers in BC builds on the study results and is capable of supporting DSM program design and implementation planning.

  - The measure TRC model is a custom-designed model that provides comprehensive profiles of all of the DSM measures assessed within the study. Because the information is provided is software form, any changes to economic, financial or performance data inputs can be easily accommodated and revised results generated automatically.

2 Study Methodology

This section provides an overview of the methodology employed for this study. More specifically, it addresses:

- Definition of terms
- Major analytic steps
- Key economic inputs
- Analytic models.

2.1 Definition of Terms

This study employs numerous terms that are unique to analyses such as this one and consequently it is important to ensure that all readers have a clear understanding of what each term means when applied to this study. Below is a brief description of some of the most important terms.

Base Year	The Base Year is the starting point for the analysis. It provides a detailed description of "where" and "how" energy is currently used in the existing Industrial sector. Creation of the Base Year required the development of profiles of current natural gas processes and equipment in each Industrial sub sector.
Reference Case (includes Natural Conservation)	The Reference Case estimates the expected level of natural gas consumption that would occur over the study period in the absence of new DSM program initiatives. It provides the point of comparison for the subsequent calculation of "economic" and "achievable" savings potentials. Creation of the Reference Case required the estimation of changes in sub sector production levels and an estimation of "natural" changes affecting energy consumption over the study period.
Technology Assessment	Energy-efficiency and alternative energy options were identified that met the criteria, as outlined in Section 1.2. Technology cost and performance data were compiled relative to the baseline technology and the measure TRC was calculated for each option. The measure TRC calculates the net present value of energy savings that result from an investment in an efficiency or alternative energy technology or measure. The measure TRC is equal to its full or incremental capital cost (depending on application) plus any change (positive or negative) in the combined annual energy and operating and maintenance (O&M) costs. This calculation includes, among others, the following inputs: the avoided natural gas and electricity supply costs, the life of the technology, and the selected discount rate, which in this analysis has been set at 7.4% for the Mainland and 6.9 % for Vancouver Island.
Economic Potential Forecasts	The Economic Potential Forecast is the level of energy consumption that would occur if all equipment and building envelopes were upgraded to the level that is cost effective, from FortisBC's perspective, when using lifecycle costing with the long-run avoided cost of new natural gas supply. All the energy-efficiency and alternative energy options included in the technology assessment that had a positive measure TRC were incorporated into the Economic Potential Forecast.

Achievable Potential The Achievable Potential is the proportion of the savings identified in the Economic Potential Forecast that could realistically be achieved within the study period. Achievable Potential recognizes that it is difficult to induce customers to purchase and install all the energy-efficiency/alternative energy or behaviour options that meet the criteria defined by the Economic Potential Forecast. The results are presented as a range, defined as "Most Likely" and "Aggressive."

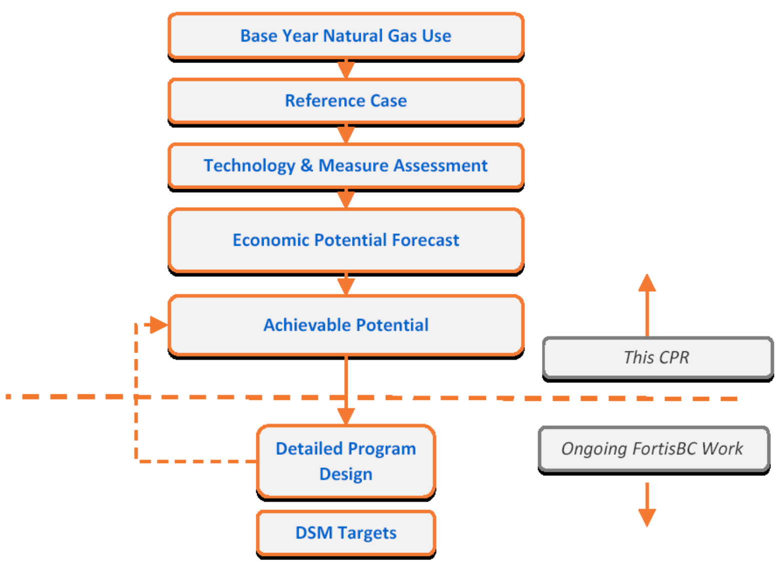
Estimates provided were developed in a workshop involving FortisBC energy-efficiency program personnel, trade allies, selected external experts and the consulting team.

Peak Day Load Impacts Load factors provided by FortisBC were used to derive peak day load impacts from the energy consumption values contained in each of the potential estimates noted above.

2.2 Overview of Approach

To meet the objectives outlined above, the study was conducted within an iterative process that involved a number of well-defined steps, as illustrated in Exhibit 1. At the completion of each step, the client reviewed the results and, as applicable, revisions were identified and incorporated into the interim results. The study then progressed to the next step.

Exhibit 1 CPR 2010: Main Analytic Steps



A summary of the steps is presented below.

Step 1: Develop Base Year Calibration Using Actual FortisBC Billing Data

- Compile and analyze available data on British Columbia's existing Industrial sub sectors.
- Develop detailed technical descriptions of the existing processes and technologies within each sub sector.
- Compile actual FortisBC billing data.
- Create sector model inputs and generate results.
- Calibrate sector model results using actual billing data.

Step 2: Develop Reference Case

- Compile data on forecast levels of output growth in each major sub sector.
- Compile data on "natural" changes in equipment efficiency levels and/or practices.
- Define sector model inputs and create forecasts of energy use for each of the milestone years.

Step 3: Develop and Assess Energy-efficiency and Alternative Energy Options

- Develop list of energy-efficiency and alternative energy measures.
- Compile detailed cost and performance data for each measure.
- Identify the baseline technologies employed in the Reference Case.
- Develop energy-efficiency and/or alternative options for each end use.
- Compile economic data, including current and forecast costs for new supply of natural gas and electricity generation.
- Determine the measure TRC for each energy-efficiency and alternative energy option.

Step 4: Estimate Economic Energy-efficiency and Alternative Energy Potential

- Screen the identified energy-efficiency and alternative energy measures from Step 3 against the economic data.
- Identify the combinations of energy-efficiency measures and building types where the measure TRC is positive.
- Apply the economically attractive energy-efficiency measures from Step 3 within the energy use model developed previously for each sub sector.
- Determine annual natural gas consumption in each sub sector when the economic efficiency measures are employed.
- Compare the consumption levels when all economic efficiency measures are used with the Reference Case consumption levels and calculate the natural gas consumption impacts.

Step 5: Estimate Achievable Savings Potential

- "Bundle" the energy-efficiency and alternative energy options identified in the Economic Potential Forecast into a set of actions.
- Create "Action Profiles" for each of the identified Actions that provide a high level rationale and direction, including target technologies and sub-markets as well as key barriers and a broad intervention strategy.
- Review historical achievable program results and prepare preliminary Action Assessment Worksheets.
- Conduct Achievable Potential workshops involving FortisBC personnel, trade allies and other stakeholders and reach general agreement on *most likely* and *aggressive* range of Achievable Potential.

Step 6: Estimate Peak Day Load Impacts of Economic and Achievable Savings Potential

- Annual energy decreases/increases contained in each of the energy-efficiency/alternative energy scenarios were converted to average daily values based on annual load profile data provided by FortisBC.
- Load factors that correlate "average" to "peak" consumption were provided by FortisBC for each rate class and service region.
- Peak day load impacts were calculated for each of the energy-efficiency and fuel choice scenario results by applying the above load factors.

2.3 Analytical Models

The analysis of the Industrial sector employed a customized spreadsheet model. The model applies appropriate end-use technologies to each sub sector in each service area. The input energy use information and equipment efficiencies are organized by service area, major sub sector, major end use, and technology.

- The service areas are the Lower Mainland, Vancouver Island, Northern Interior and Southern Interior. This study for the Industrial sector did not include any facilities located in Whistler.

- The major sub sectors are:
  - Agriculture
  - Chemical
  - Fabricated Metal
  - Food & Beverage
  - Mining
  - Miscellaneous Manufacturing
  - Non-Metal Mineral Manufacturing
  - Pulp and Paper
  - Wood Products
  - Other, including textiles, construction, and laundries.

This study includes analysis of the interruptible natural gas loads for large customers and the savings measures associated with their process requirements. As a result the Mining and Pulp and Paper sub sectors have been added for the 2010 review, compared to those sub sectors studied previously in the 2006 CPR.

The equipment or devices used to convert natural gas to heating for comfort and process are referred to as technologies. The analytical work involves estimating the number of applications over a certain time period where a standard efficiency technology will be changed out for a higher efficiency technology. Standard generally refers to equipment that is in place at the present time or the technology that is commonly used even though a higher efficiency technology is available.

The average natural gas consumption for June through August provided the basis for the annual process heat load for the industries with process consumption not affected by climate.

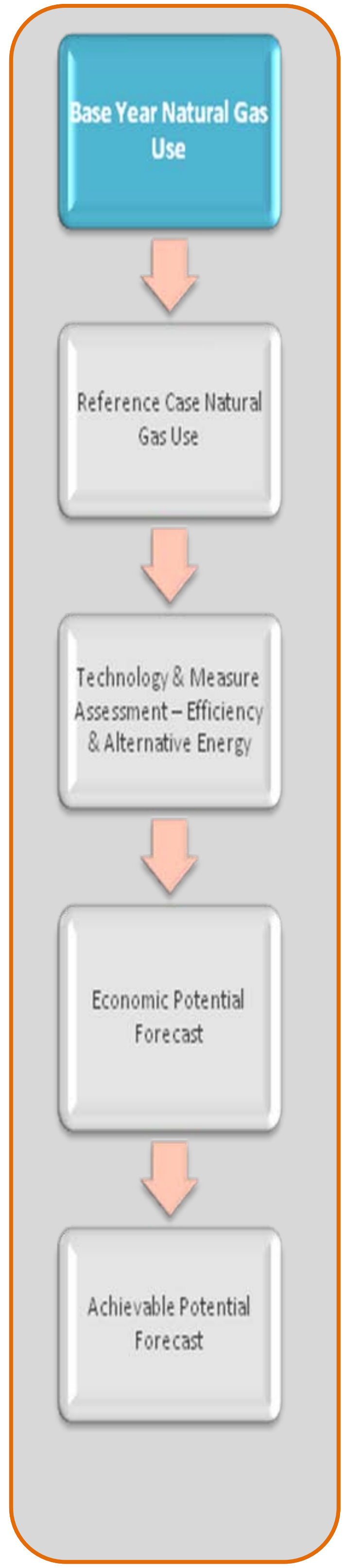
- The model recognizes and tracks efficiency improvements that can be installed on existing equipment (technologies) between milestone years. These improvements include:
  - Controls and high-efficiency burners (bundled standard upgrades)
  - Heat recovery (off of boiler)
  - Insulation – equipment and distribution systems
  - Heat recovery (off of process)
  - Optimized heat balance and control
  - Steam trap maintenance.

- The energy use changes that would occur without utility programs are in the Reference Case. There is a constant rate of improvement applied for each technology that reflects natural rate of equipment replacement and upgrades seen in B.C.'s Industrial sector.
- The natural gas sales are calculated for each sub sector and region along with the useful heat based on the conversion efficiencies of technologies for both comfort and process heating.

The primary input variables affecting the consumption of natural gas, based on industrial process, are:

- Type and efficiency of specific major processing equipment
- Energy consumption and operating hours for heating equipment
- Economic activity levels within each sub sector (useful heat requirement)
- Production processes employed.

3 Base Year (2010) Natural Gas Use



This section provides a profile of Base Year (2010) natural gas use in B.C.'s Industrial sector. The discussion is organized into the following sub sections:

- Industrial sector segmentation
- Industrial end uses
- Base Year Industrial sector natural gas use

A brief description of each of the above sub sections is provided below, including a summary of the results. Additional information is provided in Appendix A.

3.1 Industrial Sector Segmentation

The first step in developing the Base Year profile required that the industrial account information be segmented by economic sub sectors. FortisBC information includes the North American Industrial Classification System (NAICS) data for each account. To facilitate the analysis of energy-efficiency options in later stages of this analysis, the account information was summarized by sub sector and service area. The applicable natural gas-using processes and technologies were assigned to each category (NAICS/service area). The conversion efficiencies multiplied by the category share of natural gas sales yielded the useful heat consumed by each category.

The Industrial sub sectors studied in this analysis are shown in Exhibit 2

Exhibit 2 Industrial Sub Sectors

- Agriculture
- Chemical
- Fabricated Metal
- Food & Beverage
- Mining
- Miscellaneous Manufacturing
- Non-Metal Manufacturing
- Pulp and Paper
- Wood Products
- Other

3.1.1 *Interruptible Customers*

Limited information about installed equipment and industrial processes was available prior to the beginning of the 2010 CPR. In order to learn about customers and their Industrial processes, an energy use survey was conducted targeting large consumers who purchase interruptible natural gas services. Nineteen customers, representing each of the dominant Industrial sectors, were contacted and offered a phone survey and/or a site visit. Eighteen customers completed the survey and 13 customer site visits were documented.

The site visits afforded the consultants the opportunity to identify savings opportunities through first hand observation and on-the-job interviews with customer personnel. Please see Appendix A for survey details.

3.2 Industrial End Uses

Industrial natural gas use provides heating for space conditioning (comfort) and industrial processes. The industrial end-use technologies are grouped by comfort heating and process heating, as summarized in Exhibit 3.

Exhibit 3 Industrial End Uses

Process	Comfort
▪ Boilers	▪ Boilers
▪ Water heaters	▪ Air / radiant heaters
▪ Ovens	
▪ Heat treating furnaces	
▪ Lumber kilns	
▪ Veneer dryers	
▪ Paper dryers	
▪ Pulp lime kilns	
▪ Cement kilns	
▪ Ore drying	
▪ Coal drying	
▪ Direct-fired end uses	
▪ Consumed in process	

3.2.1 *Distribution of Natural Gas Consumption by Sub Sector & End Use*

Exhibit 4 shows the distribution of industrial sector natural gas consumption between process and comfort heat, by sub sector and service area. As illustrated in Exhibit 4, process heat accounts for a large share of the natural gas consumption. It should also be noted that the share of natural gas consumption for process heat is larger in this study than in the 2006 CPR study. This is due to the inclusion of the interruptible accounts with large industrial processes in this study. It is worth noting that comfort heat makes up a large part of the Fabricated Metal sub sector since these sites consist mainly of a heated building with some metal working equipment that does not require significant amounts of gas. Also, some sub sectors have only a few smaller facilities in some regions, which can skew the data to indicate more comfort heat than would normally be expected.

Exhibit 4 Process/Comfort Heat Share (Percentage) by Sub Sector and Service Area

Industrial Sub Sector	Lower Mainland		Northern Interior		Northern Interior		Vancouver Island	
	Process Heat	Comfort Heat	Process Heat	Comfort Heat	Process Heat	Comfort Heat	Process Heat	Comfort Heat
Agriculture	80%	20%	68%	32%	82%	18%	96%	4%
Chemical	95%	5%	87%	13%	68%	32%	79%	21%
Fabricated Metal	74%	26%	77%	23%	40%	60%	53%	47%
Food & Beverage	92%	8%	77%	23%	78%	22%	95%	5%
Mining	46%	54%	82%	18%	94%	6%	n/a	n/a
Miscellaneous Manufacturing	42%	58%	20%	80%	28%	72%	94%	6%
Non-Metal Mineral	93%	7%	82%	18%	53%	47%	0%	100%
Pulp & Paper	95%	5%	93%	7%	93%	7%	93%	7%
Wood Products	98%	2%	95%	5%	95%	5%	100%	0%
Other[4]	45%	55%	36%	64%	29%	71%	96%	4%

[4] Other includes sub sector such as Transportation, Construction, Printing, Utility, and Laundry & Other Services.

3.2.2 *Natural Gas Fuel Share for Heating Applications*

Exhibit 5, Exhibit 6, Exhibit 7 and Exhibit 8 provide estimates of the current natural gas versus wood waste share by equipment size for, respectively, Lower Mainland, Northern Interior, Southern Interior and Vancouver Island. Equipment size is shown in the exhibits to provide an indication of fuel options. For example, it is difficult and often impractical to use wood waste in medium size boilers or furnaces, but it can be readily used in large kilns or large boilers in greenhouses. The exhibits also present potential opportunities for increasing or maintaining the natural gas share as well as the opportunities for increasing the wood waste share.

Exhibit 5 Natural Gas Fuel Share – Lower Mainland

Equipment	Estimate of Existing Share	Opportunities for Natural Gas	Opportunities for Wood Waste
Large (Process)	90%	1/No significant opportunity to expand share. 2/ Wood waste supply is not a transparent market and supplies remain uncertain. Natural gas flexibility and reliability can play a shaping role.	1/ Significant opportunity for wood waste, wood pellets and biofuels due to greenhouse gas management policies and regulation. 2/Replacement of gas consuming processes to meet greenhouse gas reduction /carbon content targets.
Medium (Process)	95%	1/No significant opportunity to expand share.	1/No significant opportunity for wood waste
Small (Comfort)	60%	1/ In new developments gas share could be increased over electricity. 2/ In backup systems for renewable energy supplies could be increased over electricity.	1/ No significant opportunity

Exhibit 6 Natural Gas Fuel Share – Northern Interior

Equipment	Estimate of Existing Share	Opportunities for Natural Gas	Opportunities for Wood Waste
Large (Process)	90%	1/ Could be some main extension opportunities in areas not served by natural gas. 2/ Wood waste supply is not a transparent market and supplies remain uncertain. Natural gas flexibility and reliability can play a shaping role. Also, the major price change in the gas market favours continued use of natural gas.	1/ Continued significant opportunity for wood waste particularly with lumber dry kilns. Possibility of further conversion from natural gas with wood waste. 2/Replacement of gas-consuming processes to meet greenhouse gas reduction /carbon content targets. 3/ Demand destruction due to global economic impacts on exporting entities.
Medium (Process)	95%	No significant opportunity to expand share.	No significant opportunity to expand wood waste share.
Small (Comfort)	70%	1/ In new developments gas share could be increased over electricity. 2/ In backup systems for renewable energy supplies could be increased over electricity.	No significant opportunity to expand wood waste share.

Exhibit 7 Natural Gas Fuel Share – Southern Interior

Equipment	Estimate of Existing Share	Opportunities for Natural Gas	Opportunities for Wood Waste
Large (Process)	90%	1/ Could be some main extension opportunities in areas not served by natural gas. 2/ Wood waste supply is not a transparent market and supplies remain uncertain. Natural gas flexibility and reliability can play a shaping role.	1/ Significant threat from wood waste particularly with lumber dry kilns. Possibility of further erosion of that market. 2/ Demand destruction due to global economic impacts on exporting entities. Overcapacity is being rationalized.
Medium (Process)	95%	No significant opportunity to expand share.	No significant opportunity to expand wood waste share.
Small (Comfort)	70%	1/ In new developments gas share could be increased over electricity. 2/ In backup systems for renewable energy supplies could be increased over electricity.	1/ Main threat is electric because of ease of installation and designation as a carbon neutral energy source in B.C.

Exhibit 8 Natural Gas Fuel Share – Vancouver Island

Equipment	Estimate of Existing Share	Opportunities for Natural Gas	Opportunity for Wood Waste
Large (Process)	80%	1/ A continual increase in lumber drying will provide opportunity to supply more dry kilns. 2/ Wood waste supply is not a transparent market and supplies remain uncertain. Natural gas flexibility and reliability can play a shaping role. 2/ Some large equipment now using propane or oil could be switched to natural gas with main extensions.	1/Wood waste is a serious alternative for lumber drying except change in gas pricing does not favour wood waste. 2/ Demand destruction due to global economic impacts on exporting entities. Overcapacity is being rationalized.
Medium (Process)	80%	1/ Main extensions to new industrial parks.	1/ Wood pellets are alternative to natural gas for medium size boilers
Small (Comfort)	70%	1/ In new developments gas share could be increased over electricity. 2/ In backup systems for renewable energy supplies could be increased over electricity.	1/ No significant opportunity with wood waste.

Additional details related to the fuel shares shown in the above exhibits are provided below.

- **Electricity and Large Process Heating Equipment:** In many situations, it is not practical to use electricity for large capacity equipment because the cost of the electrical equipment necessary to supply the peak heating equipment costs far more than gas connection costs. This electrical equipment at the customer facility generally involves, transformers, switch gear, cabling and protection equipment.

  Gas connections can usually handle a wider range of capacity requirements than electricity connections. For example, to convert a process unit requiring an energy input of 20 GJ/hr. of gas to electricity, a high-voltage transmission connection to the BC Hydro system would be required at the customer's cost. This cost would be in the millions of dollars, compared to a typical high-pressure gas connection that would cost hundreds of thousands of dollars. Furthermore, a gas connection with an average delivery rate of 20 GJ/hr. could accommodate a peak hour demand of 30 GJ/hr. for a cost that is insignificant compared to the cost of the equivalent peak capacity high-voltage transmission connection.

- **Electricity Lumber and Veneer Dryers:** Electric dehumidification kilns have been developed and applied in some sawmills, particularly for drying hardwood, or high-end planks. However, in typical B.C. wood products facilities (dimensional lumber or stud mills), electricity does not compete with natural gas as a fuel source for dryers, because the electric dehumidification process cannot supply sufficient heat capacity to dry the lumber as fast as gas-fired kilns. Wood waste is the principle heating fuel competitor to natural gas because it has been historically a waste byproduct of sawmills and, therefore, essentially free. Wood waste-fired kilns can also be designed to supply sufficient heating capacity to dry the lumber at the required speed.

- **Electricity and Comfort Heat:** The relatively small capacity equipment used in some comfort heating applications is the one end use that is suitable for electricity use. Electricity is attractive because of the low capital cost and simplicity of installation. This difference in capital cost is offset to a certain extent by the difference in electricity and natural gas rates. For example, the BC Hydro electricity rate for their general service customers is 6.7 cents/kWh (18.56 $/GJ) while the comparable rate 5 natural gas rate for the Lower Mainland is 2.1 cents/kWh (5.96 $/GJ).[5] Electricity on a unit heating basis is more than three times as expensive as natural gas.

3.3 Base Year Industrial Natural Gas Use

This section provides a summary of the 2010 Base Year natural gas consumption organized by sub sector, service area, end use and technology. The results are presented in the following exhibits.

- Exhibit 9, Exhibit 10, and Exhibit 11 show the distribution of Base Year natural gas use by major technology for all service areas.

- Exhibit 12 through Exhibit 16 show the distribution of Base Year natural gas use by major sub sector and end use for all service areas, and each of the four service areas.

- Exhibit 18 through Exhibit 19 show the distribution of Base Year natural gas and useful heat consumed by end use for three of the sub sectors (Food & Beverage, Agriculture and Wood Products). The remaining sub sectors are presented in Appendix A.

Selected highlights of the 2010 Base Year results are provided below.

- For the 2010 Base Year, the total natural gas consumption by the Industrial sector accounts considered in this CPR study is approximately 36,456,000 GJ, for both non-interruptible and interruptible accounts. Non-interruptible consumption in the Base Year is approximately 11,466,000 GJ. The pie charts in Exhibit 9 and Exhibit 10 present the non-interruptible consumption breakdown by major end use and Industrial sub sector, respectively.

- Standard efficiency boilers used to generate process heat account for approximately 23% of the total Base Year Industrial sector natural gas use, whereas efficient and condensing boilers account for 16%.

- Wood products drying technologies, including standard and efficient lumber dry kilns and veneer dryers, account for approximately 14% of Base Year natural gas use. The remaining Base Year natural gas use is split between comfort heat, 24%, other process heat, 17%, heat treating and annealing technologies in the metal fabrication industry, 7%.

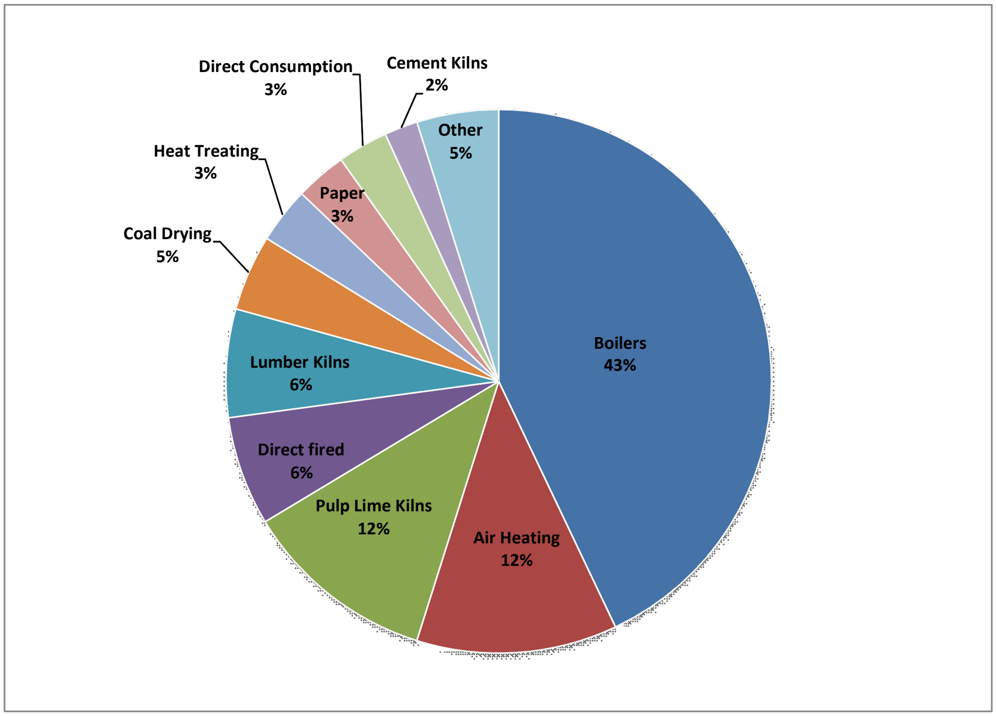
[5] Electricity rate is the marginal portion of BC Hydro's LGS conservation rate, the natural gas rate is FortisBC's schedule 5 for the Lower Mainland.

- Three sub sectors, Food & Beverage, Agriculture and Wood Products, account for over 60% of total consumption by Industrial sector non-interruptible accounts. These figures incorporate the decline in the wood products industry in B.C. since 2006. The impact of this decline on natural gas loads is discussed in FortisBC's Utilities 2010 Long Term Resource Plan.[6]

- Overall, the results contained in the following exhibits show that natural gas use by FortisBC Industrial sector accounts is dominated by boilers within the food industry, while lumber dry kilns and veneer dryers dominate in the Interior and on Vancouver Island.

Exhibit 9 2010 Base Year Natural Gas Consumption by Major End Use

– All Service Areas – Chart



6 http://www.fortisbc.com/About/RegulatoryAffairs/GasUtility/NatGasBCUCSubmissions/LowerMainlandSquamishInterior/Pages/Resource-Plans.aspx, p. 86 and 87.

Exhibit 10 2010 Base Year Natural Gas Consumption by Sub sector – All Service Areas – Chart

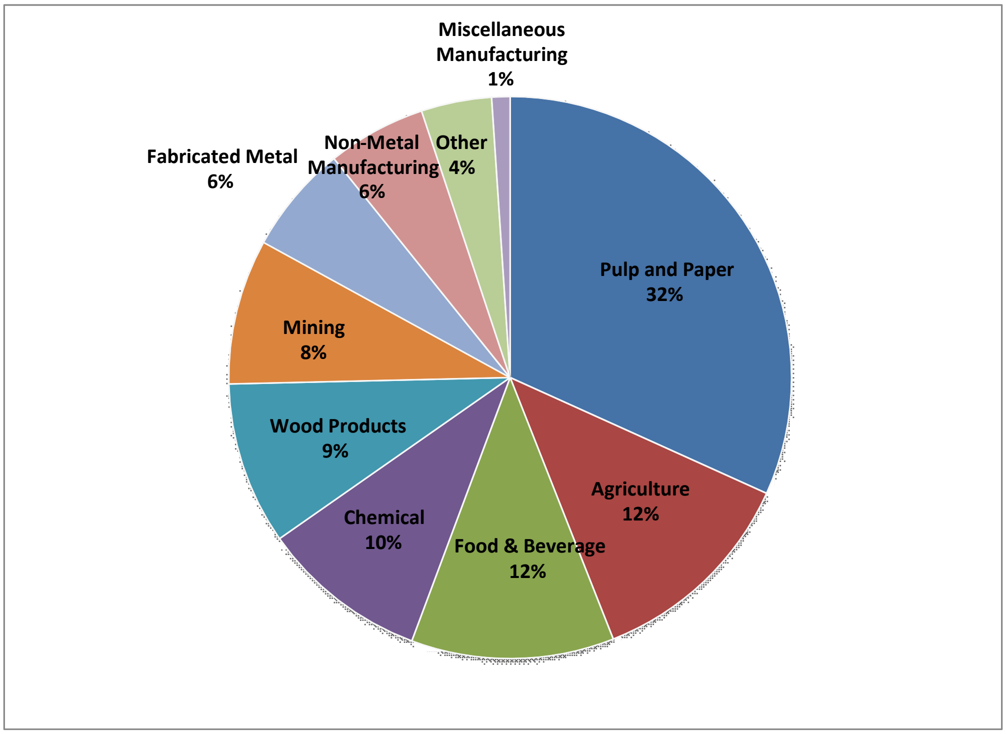


Exhibit 11 2010 Base Year Natural Gas Consumption (GJ) by Major End Use – All Service Areas – Table

	Lower Mainland	Northern Interior	Southern Interior	Vancouver Island	Total
Boilers	8,251,737	4,564,560	2,521,586	318,788	15,656,670
Air heating	2,641,147	1,002,570	516,603	184,527	4,344,846
Water heaters	284,490	93,662	61,765	49,835	489,752
Ovens	527,145	10,978	67,319	3,870	609,312
Heat treating	921,002	234,742	46,038	10,431	1,212,213
Lumber kilns	584,632	1,150,656	507,972	98,862	2,342,122
Veneer dryers	107,045	210,683	93,009	18,102	428,839
Paper	169,122	770,127	171,986	1,666	1,112,902
Pulp lime kilns	447,384	3,066,374	683,704	0	4,197,461
Cement kilns	626,953	46,350	49,065	0	722,367
Ore drying	0	145,710	0	0	145,710
Coal drying	0	0	1,642,354	0	1,642,354
Miscellaneous	5,478	236	1,452	3,870	11,036
Laundry	39,122	3,319	1,314	41,964	85,718
Direct fired	1,859,158	332,544	37,665	136,029	2,365,396
Direct consumption	810,900	233,308	3,284	41,964	1,089,456
Total	17,275,315	11,865,818	6,405,115	909,908	36,456,156

Exhibit 12 2010 Base Year Natural Gas Consumption by Sub sector – All Service Areas

	TOTAL SERVICE AREA SALES (TJ) End Use		Agriculture	Chemical	Fabricated Metal	Food & Beverage	Mining	Miscellaneous Manufacturing	Non-Metal Manufacturing	Pulp and Paper	Wood Products	Other
COMFORT HEATI	Boilers	Standard Efficiency Boiler	-	-	-	104	59	6	-	40	-	-
		Near Condensing Boilers	-	-	-	15	48	3	-	16	-	-
		Condensing Boiler	-	-	-	12	45	1	-	0	-	-
	Air Heating	Standard Efficiency Air Handling Units	633	154	341	237	29	31	323	530	98	352
		High-efficiency Air Handling Units and Unit heaters (Condensing)	181	-	69	22	11	8	46	156	14	50
		Radiant Tube Heating	90	77	282	40	29	284	92	39	28	100
PROCESS HEATING	Boilers	Standard Efficiency Boiler	686	483	86	2,169	397	8	35	3,969	231	172
		Near Condensing Boiler	289	620	65	491	369	3	17	1,638	99	76
		Condensing Boiler	2,570	110	-	357	284	-	-	-	33	51
	Water Heaters	Tank-type Water Heating	72	-	-	119	-	6	-	-	-	50
		Instantaneous Water Heater	-	-	-	48	-	6	-	-	-	24
		Direct-fired Water Heating	-	-	-	-	-	-	-	-	165	-
	Ovens	Standard Efficiency Oven	-	-	-	255	-	6	94	-	-	-
		Efficient Oven	-	-	-	232	-	6	17	-	-	-
	Heat Treating	Standard Efficiency Heat Treating Furnace	-	-	754	-	-	6	-	-	-	-
		Heat Treating Furnace with Sequential Firing, High Velocity Burners	-	-	447	-	-	6	-	-	-	-
	Lumber Kiln	Standard Efficiency Kiln	-	-	-	-	-	-	-	-	2,078	-
		High-efficiency Kiln	-	-	-	-	-	-	-	-	264	-
	Veneer Dryers	Standard Efficiency Veneer Dryer	-	-	-	-	-	-	-	-	330	-
		Advanced Veneer Dryer	-	-	-	-	-	-	-	-	99	-
	Paper	Direct-fired Paper Drying	-	-	-	-	-	-	-	1,113	-	-
	Pulp Lime Kilns	Standard Efficiency Pulp Lime Kilns	-	-	-	-	-	-	-	3,148	-	-
		High-efficiency Pulp Lime Kilns	-	-	-	-	-	-	-	1,049	-	-
	Cement Kilns	Standard Efficiency Cement Kilns	-	-	-	-	-	-	653	-	-	-
		High-efficiency Cement Kilns	-	-	-	-	-	-	69	-	-	-
	Ore Drying	Standard Efficiency Ore Dryer	-	-	-	-	146	-	-	-	-	-
		High-efficiency Ore Dryer	-	-	-	-	-	-	-	-	-	-
	Coal Drying	Standard Efficiency Coal Dryer	-	-	-	-	1,642	-	-	-	-	-
		High-efficiency Coal Dryer (with centrifuge)	-	-	-	-	-	-	-	-	-	-
	Miscellaneous	Miscellaneous Standard Equipment	-	-	-	-	-	6	-	-	-	-
		Miscellaneous Efficient Equipment	-	-	-	-	-	6	-	-	-	-
	Laundry	Direct-fired Gas Laundry Dryers	-	-	-	-	-	-	-	-	-	86
	Direct Fired	Direct-fired Heating	-	1,105	254	199	14	-	747	-	-	47
	Direct Consumption	Gas Consumed in Process	-	992	-	-	-	-	-	-	-	97
		Total	**4,523**	**3,541**	**2,298**	**4,301**	**3,072**	**388**	**2,093**	**11,697**	**3,439**	**1,105**

Exhibit 13 2010 Base Year Natural Gas and Useful Heat Consumption - Agriculture – All Service Areas

END USE	Agriculture	Annual Sales: Market Share (%)	Annual Sales: Total Sales (GJ)	Annual Useful Heat: Conversion & Process Efficiency (%)	Annual Useful Heat: Total Useful Heat (GJ)
Air heating	Standard Efficiency Air Handling Units and Unit Heaters	14%	633,268	55%	348,804
	High-efficiency Air Handling Units and Unit heaters (Condensing)	4%	180,934	68%	123,107
	Radiant Tube Heating	2%	90,467	56%	65,654
Boilers - process	Standard Efficiency Boiler	15%	686,110	55%	377,993
	Near Condensing Boiler	6%	289,429	74%	213,985
	Condensing Boiler	57%	2,569,961	90%	2,320,888
Water heaters	Tank-type Water Heating	2%	72,357	42%	30,314
Total		**100%**	**4,522,525**		**3,480,746**

Exhibit 14 2010 Base Year Natural Gas and Useful Heat Consumption - Food and Beverage – All Service Areas

END USE	Food & Beverage	Annual Sales: Market Share (%)	Annual Sales: Total Sales (GJ)	Annual Useful Heat: Conversion & Process Efficiency (%)	Annual Useful Heat: Total Useful Heat (GJ)
Boilers	Standard Efficiency Boiler	2%	103,911	51%	53,177
	Near Condensing Boilers	0.4%	15,218	59%	8,927
	Condensing Boiler	0.3%	12,273	67%	8,218
Air heating	Standard Efficiency Air Handling Units and Unit Heaters	6%	237,246	52%	123,554
	High-efficiency Air Handling Units and Unit heaters (Condensing)	1%	21,532	65%	13,937
	Radiant Tube Heating	1%	40,459	58%	30,075
Boilers - process	Standard Efficiency Boiler	50%	2,168,635	50%	1,080,545
	Near Condensing Boiler	11%	490,839	58%	282,320
	Condensing Boiler	8%	356,743	65%	232,364
Water Heaters	Tank-type Water Heating	3%	119,499	45%	54,025
	Instantaneous Water Heater	1%	47,800	61%	29,024
	Direct-fired Water Heating	5%	199,366	63%	125,003
Ovens	Standard Efficiency Oven	6%	255,117	70%	177,817
	Efficient Oven	5%	231,971	82%	191,026
Total		100%	4,300,611		2,410,013

Exhibit 15 2010 Base Year Natural Gas and Useful Heat Consumption – Wood Products – All Service Areas

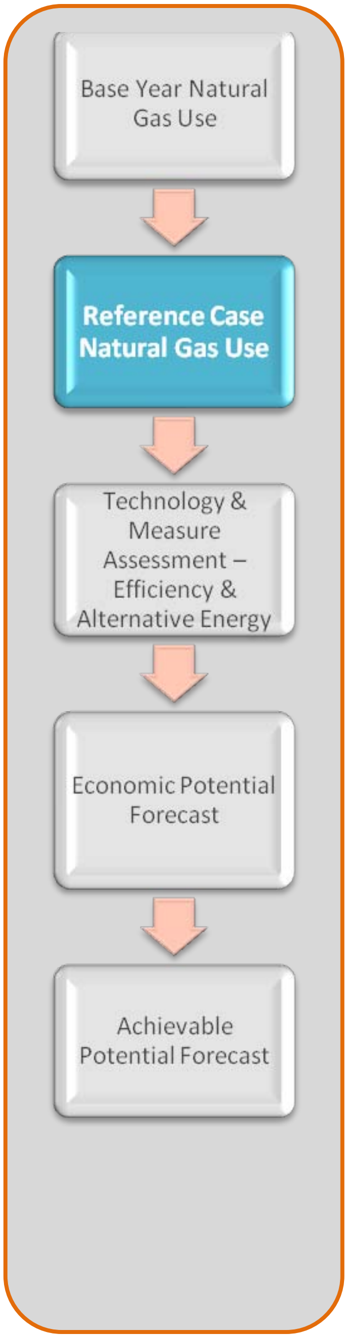
	Wood Products	Annual Sales		Annual Useful Heat	
END USE		Market Share (%)	Total Sales (GJ)	Conversion & Process Efficiency (%)	Total Useful Heat (GJ)
Air heating	Standard Efficiency Air Handling Units and Unit Heaters	3%	98,458	53%	51,960
	High-efficiency Air Handling Units and Unit heaters (Condensing)	<.01%	14,065	66%	9,266
	Radiant Tube Heating	<.01%	28,131	58%	21,140
Boilers	Standard Efficiency Boiler	7%	230,913	51%	117,296
	Near Condensing Boiler	3%	98,963	58%	57,361
	Condensing Boiler	<.01%	32,988	66%	21,612
	Direct-fired Water Heating	5%	164,938	63%	103,416
Lumber kiln	Standard Efficiency Kiln	60%	2,078,221	62%	1,290,575
	High-efficiency Kiln	8%	263,901	89%	233,552
Veneer dryers	Standard Efficiency Veneer Dryer	10%	329,876	52%	171,866
	Advanced Veneer Dryer	3%	98,963	71%	70,264
Total		100%	3,439,418		2,148,309

Exhibit 16 2010 Base Year Natural Gas and Useful Heat Consumption – Pulp and Paper – All Service Areas

	Pulp and Paper	Annual Sales		Annual Useful Heat	
END USE		Market Share (%)	Total Sales (GJ)	Conversion & Process Efficiency (%)	Total Useful Heat (GJ)
Boilers	Standard Efficiency Boiler	<.01%	39,505	67%	26,553
	Near Condensing Boilers	<.01%	15,932	73%	11,645
	Condensing Boiler	<.01%	26	64%	17
Air heating	Standard Efficiency Air Handling Units and Unit Heaters	5%	529,543	56%	294,024
	High-efficiency Air Handling Units and Unit heaters (Condensing)	1%	155,541	69%	107,820
	Radiant Tube Heating	<.01%	39,113	61%	30,702
Boilers	Standard Efficiency Boiler	34%	3,969,284	65%	2,567,139
	Near Condensing Boiler	14%	1,637,585	71%	1,165,505
Paper	Direct-fired Paper Drying	10%	1,112,902	88%	974,902
Pulp lime kilns	Standard Efficiency Pulp Lime Kilns	27%	3,148,096	75%	2,376,812
	High-efficiency Pulp Lime Kilns	9%	1,049,365	91%	954,922
Total		99%	11,696,893		8,510,042

4 Reference Case Natural Gas Use

4.1 Introduction



This section presents the Industrial sector Reference Case for the study period (2010 to 2030) The Reference Case estimates the expected level of natural gas consumption that would occur over the study period in the absence of new energy-efficiency or fuel choice initiatives. The Reference Case, therefore, provides the point of comparison for the subsequent calculation of economically attractive energy-efficiency opportunities.

The discussion is presented within the following sub sections:

- Approach
- "Natural" efficiency improvements
- Expected growth in Industrial sector useful heat requirements
- Summary of model results.

4.2 Approach

The Industrial sector Reference Case was developed using a custom spreadsheet-based model. As noted previously, the three major input variables used within the model to determine the forecast levels of natural gas consumption over the study period are:

- Activity levels within each sub sector (useful heat requirements)
- Production processes employed
- The type and efficiency of specific major operating equipment.

The following steps were employed:

- The Base Year established the natural gas and useful heat consumption by each of the technologies for each of the sub sectors.
- The model recognizes and tracks efficiency improvements between milestone years for installed equipment and the process resulting from upgrades such as:
  - Controls and high-efficiency burners (bundled standard upgrades)
  - Heat recovery (off of boiler)
  - Insulation – equipment and distribution systems
  - Heat recovery (off of process)
  - Optimized heat balance and control
  - Steam trap maintenance.
- The natural gas consumption and useful heat for each technology for the milestone years were calculated using the model conversion efficiency changes due to efficiency upgrades occurring over the study period.

4.3 "Natural" Efficiency Improvements

4.3.1 Major Equipment Change Out

Growth in the amount of natural gas sold to the Industrial sector will be partially reduced due to "natural" increases in the use of more efficient technologies. Exhibit 17 presents the annual replacement rate based on the expected life of the equipment. Appendix B provides the assumptions for the efficiency upgrades, changes in conversion efficiency, and impact on market share for the conversion devices considered within each sub sector.

Exhibit 17 Expected Annual Turnover – Major Equipment

Equipment	Annual Replacement
Comfort heating	
Air heaters	5.0%
Process heating	
Boilers	4.0%
Water heaters	6.7%
Ovens	6.7%
Heat treating ovens	6.7%
Lumber kilns	6.7%
Veneer dryers	6.7%
Paper dryers	4.0%
Lime kilns	<2%
Cement kilns	<2%
Ore drying	4.0%
Coal drying	4.0%

The increasing share of more efficient boilers within the Industrial sector assumes an average boiler life of 25 years.[7] The natural increase in the market share of near condensing and condensing boilers is based on knowledge of the needs of the sub sectors, and an informal survey of suppliers to the commercial marketplace, which indicates that 70% of boilers sold today are standard type, 20% are near condensing and 10% are condensing. The food sector and greenhouses are the Industrial sub sectors best suited for condensing boiler uptake due to the amount of domestic water used and the low process temperatures needed. When boilers are up for replacement, it was assumed that 20% will be replaced with higher efficiency models as appropriate.

Water heaters for processing have a 15-year expected life. Instantaneous water heaters available today are relatively small with limited capacity and therefore are not expected to significantly penetrate the Industrial sector. Where applicable, standard water heaters were assumed to be replaced with more efficient instantaneous water heaters 20% of the time when they have reached end of life. Note that this end use is very small in the Industrial sector and typically limited to office space and small food processors.

[7] Boiler life depends on many factors including boiler water chemistry, materials used for the boiler tubes and headers, and the return water temperature relative to the materials in contact with the boiler water. Nominal range is 10-20 years for boilers with steel tubes and 15-30 years for cast iron tubes. Near condensing and condensing boilers may last longer than standard boilers because this type of boiler is more immune to cooler return water temperatures.

Baking ovens, heat treating ovens, lumber kilns veneer dryers and miscellaneous equipment all have an expected life of 15 years. It was assumed that 20% of these units are replaced with higher efficiency models when replacement is needed.

There has been recent interest in direct-fired paper drying technology expressed by some of the paper mills surveyed. However, no projects were scheduled for implementation at the time of the survey. It was assumed that there was no change over from steam drying to direct-fired drying during the Reference Case.

Based on discussions with pulp and paper mills about high-efficiency pulp kilns, there is unlikely to be any new installations or major upgrades during the study period. The Reference Case has no change in penetration of these kilns.

Upgrades to coal and ore dryers are dependent on remaining mine life. It is assumed that over the period of this study there would be no natural replacement of existing units with higher efficiency technology.

Cement kilns are assumed to undertake major rework every 25 years. It was assumed that 20% of these units are upgraded with higher efficiency technology during these rework periods.

4.3.2 Equipment or Process Upgrades

Switching out older, less efficient energy conversion devices with newer more efficient technology is a straightforward approach to energy conservation. Also, modifications to the existing equipment can also increase efficiency. Examples would be burner and control upgrades, heat recovery off of the exhaust or boiler blowdown, and insulation of the device.

There is also the potential for large efficiency gains by making improvements to the existing process or process equipment. For example, efficiency improvements can be gained through optimization of plant heat balance and control systems, heat recovery off of the process, and reduction in losses through methods like steam trap maintenance, insulation and greenhouse energy curtains.

Other conversion device upgrades include:

- Improved combustion controls and high-efficiency burner (bundled standard upgrades)
  - It is assumed that the penetration rate of this efficiency upgrade increases 5% every five years, with the exclusion of upgrades to pulp kilns, cement kilns, ore and coal dryers.
- Heat recovery
  - Heat recovery on the applicable conversion devices is assumed to occur on 25% of the equipment that is naturally being replaced, with the exclusion of upgrades to pulp kilns, cement kilns, ore and coal dryers. This means the penetration rate increases by 5% every five years.
- Insulation
  - It is assumed that the rate of deterioration of insulation matches the rate of replacement overall. Therefore, no natural increase in penetration rate occurs over the study period.
- Process heat system upgrades
- Insulation on distribution systems
  - It is assumed that the rate of deterioration of insulation matches the rate of replacement overall. Therefore, no natural increase in penetration rate occurs over the study period.
- Heat recovery (includes condensate upgrades)

    - Heat recovery on the applicable process and on building HVAC (exhaust air heat recovery) is assumed to naturally increase at a rate of 5% every five years.

- Optimized heat balance and controls
    - Optimized HVAC system control is considered to improve at a rate of 5% every five years.
    - Process heat balance and control optimization is considered to improve at a rate of 5% every five years, meaning that 13% of control systems are optimized if their expected life averages 12 years.

- Steam trap maintenance
    - It is assumed that the rate of deterioration of steam traps matches the rate of replacement/repair overall. Therefore, no natural increase in penetration rate occurs over the study period.

For the Reference Case, Exhibit 18 indicates the expected penetration rates over the equipment life for comfort and process heating upgrades.

Exhibit 18 Natural Efficiency Upgrades*

	Natural Penetration Rate Change
Conversion device equipment upgrades	
Bundled standard upgrades (controls and high-efficiency burners)	5%
Heat recovery	5%
Insulation	0%
Process and distribution system upgrades	
Insulation on distribution systems	0%
Heat recovery (includes condensate system upgrades)	5%
Optimized heat balance and control	5%
Steam trap maintenance	0%

**Excluding pulp and cement kilns and ore and coal dryers*

Exhibit 19 uses the Food & Beverage sub sector to illustrate the calculation method used in this CPR analysis. As illustrated in Exhibit 19, the conversion and process efficiency for the Base Year and milestone years are shown, along with the change in market share for each of the applicable end-use technologies for the periods between the milestone years.

Exhibit 19 Reference Case Major Technologies Efficiency Upgrades

Food & Beverage - Milestone Years

UPGRADES

COMFORT HEATING

END USE	TECHNOLOGY	Food & Beverage Base Equipment Efficiency	2010 Conversion Device Efficiency	2010 Process System Efficiency	Change in Market Share	2015 Conversion Device Efficiency	2015 Process System Efficiency	Change in Market Share	2020 Conversion Device Efficiency	2020 Process System Efficiency	Change in Market Share	2025 Conversion Device Efficiency	2025 Process System Efficiency	Change in Market Share	2030 Conversion Device Efficiency	2030 Process System Efficiency
Boilers	1 Standard Efficiency Boiler	68%	72%	71%	-1%	73%	72%	-1%	74%	74%	-1%	75%	75%	-1%	76%	77%
	2 Near Condensing Boilers	80%	82%	71%	0%	83%	72%	0%	83%	74%	0%	84%	75%	0%	85%	77%
	3 Condensing Boiler	92%	93%	71%	0%	93%	72%	0%	93%	74%	0%	93%	75%	0%	93%	77%
Air Heating	4 Standard Efficiency Air Handling Units and Unit Heaters	70%	73%	69%	-3%	74%	70%	-3%	74%	72%	-3%	74%	73%	-3%	74%	75%
	5 High efficiency Air Handling Units and Unit heaters	90%	92%	69%	1%	92%	70%	1%	92%	72%	1%	92%	73%	1%	92%	75%
	6 Radiant Tube Heating	70%	70%	80%	1%	70%	81%	1%	70%	82%	1%	70%	83%	1%	70%	84%

PROCESS HEATING

END USE	TECHNOLOGY	Food & Beverage Base Equipment Efficiency	2010 Conversion Device Efficiency	2010 Process System Efficiency	Change in Market Share	2015 Conversion Device Efficiency	2015 Process System Efficiency	Change in Market Share	2020 Conversion Device Efficiency	2020 Process System Efficiency	Change in Market Share	2025 Conversion Device Efficiency	2025 Process System Efficiency	Change in Market Share	2030 Conversion Device Efficiency	2030 Process System Efficiency
Boilers	1 Standard Efficiency Boiler	68%	72%	71%	-2%	73%	72%	-2%	74%	74%	-2%	75%	76%	-2%	76%	78%
	2 Near Condensing Boiler	80%	82%	71%	1%	83%	72%	1%	83%	74%	1%	84%	76%	1%	85%	78%
	3 Condensing Boiler	92%	93%	71%	1%	93%	72%	1%	93%	74%	1%	93%	76%	1%	93%	78%
Water Heaters	4 Tank-type Water Heating	65%	69%	66%	0%	69%	67%	0%	69%	67%	0%	69%	68%	0%	70%	68%
	5 Instantaneous Water Heater	92%	92%	66%	0%	92%	67%	0%	92%	67%	0%	92%	68%	0%	92%	68%
	6 Direct Fired Water Heating	95%	95%	66%	#REF!	95%	68%	#REF!	95%	70%	#REF!	95%	71%	#REF!	95%	73%
Ovens	7 Standard Efficiency Oven	65%	70%	100%	-1%	71%	100%	-1%	71%	100%	-1%	72%	100%	-1%	73%	100%
	8 Efficient Oven	80%	83%	100%	1%	83%	100%	1%	84%	100%	1%	84%	100%	1%	85%	100%
Heat Treating	9 Standard Efficiency Heat Treating Furnace	25%	-	-	0%	-	-	0%	-	-	0%	-	-	0%	-	-
	10 Heat Treating Furnace with Sequential Firing, High Velocity	40%	-	-	0%	-	-	0%	-	-	0%	-	-	0%	-	-
Lumber Kiln	11 Standard Efficiency Kiln	57%	-	-	0%	-	-	0%	-	-	0%	-	-	0%	-	-
	12 High Efficiency Kiln	87%	-	-	0%	-	-	0%	-	-	0%	-	-	0%	-	-
Veneer Dryers	13 Standard Efficiency Veneer Dryer	50%	-	-	0%	-	-	0%	-	-	0%	-	-	0%	-	-
	14 Advanced Veneer Dryer	70%	-	-	0%	-	-	0%	-	-	0%	-	-	0%	-	-
Paper	16 Direct Fired Paper Drying	87%	-	-	0%	-	-	0%	-	-	0%	-	-	0%	-	-
Pulp Lime Kilns	17 Standard Efficiency Pulp Lime Kilns	57%	-	-	0%	-	-	0%	-	-	0%	-	-	0%	-	-
	18 High Efficiency Pulp Lime Kilns	87%	-	-	0%	-	-	0%	-	-	0%	-	-	0%	-	-
Cement Kilns	19 Standard Efficiency Cement Kilns	52%	-	-	0%	-	-	0%	-	-	0%	-	-	0%	-	-
	20 High Efficiency Cement Kilns	78%	-	-	0%	-	-	0%	-	-	0%	-	-	0%	-	-
Ore Drying	21 Standard Efficiency Ore Dryer	50%	-	-	0%	-	-	0%	-	-	0%	-	-	0%	-	-
	22 High Efficiency Ore Dryer	75%	-	-	0%	-	-	0%	-	-	0%	-	-	0%	-	-
Coal Drying	23 Standard Efficiency Coal Dryer	50%	-	-	0%	-	-	0%	-	-	0%	-	-	0%	-	-
	24 High Efficiency Coal Dryer (with centrifuge)	75%	-	-	0%	-	-	0%	-	-	0%	-	-	0%	-	-
Miscellaneous	25 Miscellaneous Standard Equipment	65%	-	-	0%	-	-	0%	-	-	0%	-	-	0%	-	-
	26 Miscellaneous Efficient Equipment	80%	-	-	0%	-	-	0%	-	-	0%	-	-	0%	-	-
Laundry	27 Direct Fired Gas Laundry Dryers	50%	-	-	0%	-	-	0%	-	-	0%	-	-	0%	-	-
Direct Fired	28 Direct Fired Heating	50%	-	-	0%	-	-	0%	-	-	0%	-	-	0%	-	-
Direct Consumption	29 Gas Consumed in Process	100%	-	-	0%	-	-	0%	-	-	0%	-	-	0%	-	-

4.4 Production Levels to 2030

The Reference Case relies on the FortisBC sub sector and rate forecasts to 2030. The decline in B.C. industrial output since 2005, with 2007 and 2008 possibly the trough years, has had an impact on the forecasts. For the purposes of this study, the Base Year reflects some of the upswing in B.C.'s economic activity seen in 2009 and early 2010 but the change in forecasted load between milestone years has been maintained, with an overall decline in natural gas sales to the Industrial sector of almost 20% to 2030.

The model takes an end-use approach to determining energy consumption by equipment and technologies employed in Industrial sub sectors. Combined with the forecasted decline in natural gas consumption, the study results will be focused on changing out currently installed equipment at end of life with high-efficiency equipment and, where economic, replacing equipment before end of life with high-efficiency equipment.

4.5 Summary of Model Results

This section presents the results of the model runs for the entire study period. The results are presented for the total FortisBC service territory. Additional details are provided in Appendix B.

- Exhibit 20 presents the total natural gas consumption (GJ) for the Base Year and milestones years for each service area.
- Exhibit 21 presents the Base Year and milestone years' natural gas and useful heat consumption by sub sector for all service areas. The remainder of the tables (by region and by technology) is in Appendix B.

Exhibit 20 Reference Case Natural Gas Consumption (GJ) – By Service Area

Year	Lower Mainland	Northern Interior	Southern Interior	Vancouver Island	Total
Base Year 2010	17,275,315	11,865,818	6,405,115	909,908	**36,456,156**
Milestone Year 2015	13,766,798	8,942,003	5,127,126	758,336	**28,594,262**
Milestone Year 2020	13,589,638	8,919,496	5,113,276	744,748	**28,367,158**
Milestone Year 2025	13,421,162	8,898,091	5,100,106	731,826	**28,151,185**
Milestone Year 2030	13,260,942	8,877,736	5,087,581	719,537	**27,945,797**

Exhibit 21 Reference Case Natural Gas Consumption (GJ) –
– By Sub Sector

Sub Sector	2010	2015	2020	2025	2030
Agriculture	4,522,525	3,176,184	3,159,952	3,144,517	3,129,837
Chemical	3,540,666	3,376,779	3,376,779	3,376,779	3,376,779
Fabricated Metal	2,297,858	1,340,346	1,274,656	1,212,185	1,152,776
Food & Beverage	4,300,611	3,896,877	3,896,877	3,896,877	3,896,877
Mining	3,071,601	2,533,909	2,533,909	2,533,909	2,533,909
Miscellaneous Manufacturing[8]	388,324	355,207	337,798	321,243	305,499
Non-Metal Manufacturing	2,093,340	1,769,216	1,682,507	1,600,047	1,521,629
Other	1,104,921	720,725	685,402	651,811	619,865
Pulp and Paper	11,696,893	8,219,713	8,213,971	8,208,511	8,203,319
Wood Products	3,439,418	3,205,306	3,205,306	3,205,306	3,205,306
Total	36,456,156	28,594,262	28,367,158	28,151,185	27,945,797

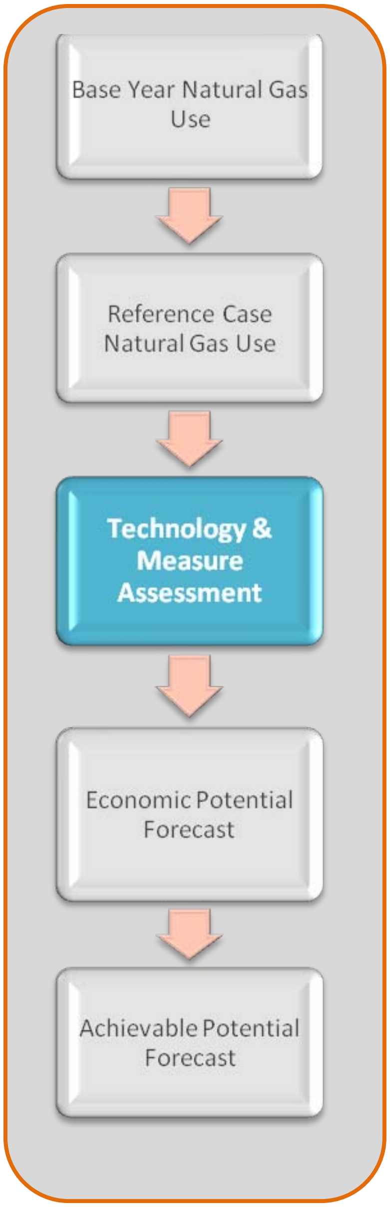
The results of the Reference Case analysis show that useful heat requirements will be reduced over the study period as more efficient equipment replaces existing equipment at end of life and/or system upgrades are completed.

Sub sectors relying on boilers for the majority of heating (process and comfort) may well see their useful heat requirements decline over the study period. In the Pulp and Paper sector, a change in technology (boiler steam replaced by direct heating for paper drying) will reduce useful heat needed for drying.

[8] Miscellaneous Manufacturing includes Machinery Manufacturing, Transportation Equipment Manufacturing, Ventilation, Heating, Air Conditioning and Commercial Refrigeration Equipment Manufacturing, and Electrical Equipment, Appliance and Component Manufacturing

5 Technology & Measure Assessment

5.1 Introduction



This section identifies and assesses the financial and economic attractiveness of the selected energy-efficiency and alternative energy measures for the Industrial sector. The discussion is organized and presented as follows:

- Methodology
- Energy-efficiency and alternative energy technologies
- Summary of results.

5.2 Methodology

The following steps were employed to assess the energy-efficiency and fuel choice technologies:

- Select candidate energy-efficiency and fuel choice technologies
- Establish technical performance for each technology within a range of applicable load sizes and/or service region conditions
- Establish the capital, installation and operating costs for each technology
- Calculate the simple payback from the customer's perspective
- Calculate the measure total resource cost (measure TRC)
- Calculate the benefit-cost ratio.

A brief discussion of each step is outlined below.

Step 1 Select Candidate Technologies

The candidate technologies were selected in close collaboration with FortisBC personnel based on a combination of a literature review and the previous experience of both the consultants and FortisBC personnel. The selected technologies are all considered to be technically proven and commercially available, even if only at an early stage of market entry. Technology costs, which will be addressed in this section, were not a factor in this initial selection of candidate technologies.

Step 2 Establish Technical Performance

Information on the performance improvements provided by each technology was compiled from available secondary sources, including the on-going research work of study team members. As applicable, the energy impacts of the technical technologies are reported for both natural gas and electricity.

Step 3 Establish Capital, Installation and Operating Costs for Each Technology

Information on the cost of implementing each technology was compiled from secondary sources, including the on-going research work of study team members. As applicable, both the incremental and full cost of each technology was estimated.

The incremental cost is applicable when a technology is installed in a new facility or at the end of the technology's useful life in an existing facility; in this case, incremental cost is defined as the difference between the efficient or fuel choice technology relative to the baseline technology. The full cost is applicable when an operating piece of equipment is replaced with the efficient or fuel choice technology prior to the end of the baseline technology's useful life.

In both cases, the costs and savings are annualized, based on the number of years of equipment life and the discount rate, and the costs incorporate applicable changes in annual operating and maintenance costs. All costs are expressed in constant (2010) dollars.

Step 4 Calculate Simple Payback

The simple payback is generated to show the customer's financial perspective. Simple payback is "*a measure of the length of time required for the cumulative savings from a project to recover its initial investment cost and other accrued costs, without taking into account the time value of money. The simple payback period is usually measured from the service date of the project*."[9] The cost of the measure (incremental or full, as appropriate) is divided by the expected annual savings. The answer is given in years**.**

The following equation illustrates how this calculation is applied to a situation where an upgrade has a higher upfront cost than the baseline technology, but lower ongoing operating costs:

$$\text{Payback}_{\text{(years)}} = (\text{CostUpgr} - \text{CostBase})/(\text{AnnBase} - \text{AnnUpgr})$$

Where:

CostUpgr	= initial capital cost of the upgrade ($)
CostBase	= initial capital cost of the baseline technology ($)
AnnBase	= ongoing operating cost of the baseline technology ($/yr.)
AnnUpgr	= ongoing operating cost of the upgrade ($/yr.)

Initial capital cost of the upgrade is the cost of equipment and installation of the energy-efficient technology while the initial capital cost of the baseline technology is the cost of equipment installation of the standard or baseline technology. The ongoing operating cost of the baseline technology is the cost to operate, including fuel cost, the baseline or standard technology while the ongoing operating cost of the upgrade is the cost to operate, including fuel cost, the energy-efficient technology.

Step 5 Calculate the Measure Total Resource Cost (TRC)

The measure TRC calculates the net present value of energy savings that result from an investment in an efficiency or fuel choice technology or measure. The measure cost is equal to its full or incremental capital cost (depending on application) plus any change (positive or negative) in annual operating and maintenance costs. The calculation of energy savings is based on the avoided natural gas and electricity supply costs, the life of the technology, and the selected discount rate, which in this analysis has been set at 7.4% for the Mainland and 6.9 % for Vancouver Island.

A technology or measure with a positive measure TRC value is included in subsequent phases of the analysis, which consists of the Economic and Achievable Potential scenarios. A measure with a negative measure TRC value is not economically attractive and is therefore not included in subsequent stages of the analysis.

[9] Sieglinde K. Fuller and Stephen R. Petersen. (1996). *Life Cycle Costing Manual for the Federal Energy Management Program.* National Institute of Standards and Technology Handbook 135, 1995 Edition, Washington, DC.

It should be noted that the measure TRC provides an initial screen of the technical technologies. Considerations such as program delivery costs, incentives etc., are incorporated in later stages of the program design process, which are beyond the scope of the study.

Step 6 Calculate Benefit-Cost Ratio

The measure benefit-cost ratio indicates the relative attractiveness of the measures. A measure that has a benefit-cost ratio in excess of "1" means that the measure's benefits outweigh its costs; it is, therefore, included in subsequent stages of the analysis. Similarly, a measure with a benefit-cost ratio that is well in excess of one (e.g., 3) means that it is very attractive. A measure with a benefit-cost ratio of less than one means that its costs outweigh its benefits and, hence, it is not included in subsequent stages of the analysis.

5.2.1 Energy Costs

The financial and economic results that are presented in this section are based on the following

- Avoided supply cost of natural gas
- Avoided supply cost of electricity
- Customer energy prices.

A brief discussion of each is provided below.

Avoided Supply Cost of Natural Gas

Natural gas avoided supply costs were provided by FortisBC[10] and are summarized in Exhibit 22. As illustrated, the avoided cost of gas on a per unit basis includes three components: an estimate of the commodity cost, an estimate of the distribution cost and the carbon tax.

- The commodity cost is based on the 10-year Alberta Energy Company (AECO) price forecast according to GLJ Petroleum Consultants (an independent energy consultant) based on their latest available forecast (updated by GLJ each quarter).

- The distribution costs are estimated by calculating an approximation of the pipeline transportation charges required by FortisBC to move the commodity supply to core markets as well as the storage costs associated with meeting winter load requirements.

- The carbon tax values shown are based on current estimates of $25/ton for 2011 and then remaining constant at $30/ton from 2012 and beyond.

The resulting avoided costs represent FortisBC's expected marginal cost to serve customers on a per unit basis. In this study, no distinction has been made between high load factor (flat) and low load factor (peaky) load shapes, or between different service areas within the province. Exhibit 22 provides a summary of the avoided natural gas supply costs on the basis of measure life.

[10] 1 kWh =3.6 MJ; 1GJ = 1000 MJ

Exhibit 22 Natural Gas – Avoided Supply Costs

	Marginal Cost of New Supply ($/GJ)			
Measure Life (Years)	**10**	**15**	**20**	**25**
Service Area				
Vancouver Island	12.97	14.25	15.64	15.64
Mainland	12.97	14.25	15.64	15.64

Avoided Supply Cost of Electricity

The avoided supply cost of electricity used in this analysis for was provided by FortisBC.[11] The $0.12 per kWh is consistent with BC Hydro's cost of new supply based on the successful bid responses to recent energy calls for new power. An adjustment reflecting the cost of demand was added to the cost of energy. The incremental demand cost of $170 for 1 kW for a year at 90% load factor adds approximately $0.02 per kWh to the energy cost, resulting in an avoided supply cost for industrial loads of approximately $0.14 per kWh. Exhibit 23 presents the avoided supply cost denominated in gigajoules (GJ).

A low load factor avoided cost of electricity was also calculated, based on a load factor of 65%. The result was an avoided electricity supply cost of approximately $0.15 per kWh for low load factor accounts.

The purpose of applying the low load factor avoided cost is to capture the additional benefits of reducing space heating and other loads that are highly coincidental with system peaks.

The same electricity avoided cost values apply to all service areas.

Exhibit 23 Electricity – Avoided Supply Costs

	Marginal Cost of New Supply ($/GJ)			
Measure Life (Years)	**10**	**15**	**20**	**25**
Service Area				
Vancouver Island	44.54	44.54	44.54	44.54
Mainland	44.54	44.54	44.54	44.54

Customer Energy Prices

The customer energy prices used in this analysis are presented in Exhibit 24. These values are used in the calculation of customer payback periods that are presented in later sections of this report. The electricity and natural gas prices were provided by FortisBC for the Residential and Commercial accounts. The prices shown are based on current rate schedules and, in the case of electricity, incorporate consideration of estimated demand charges. Where more than one rate schedule was applicable to a given sector, the rates were blended in approximately the same ratio as energy sales.

Industrial customer natural gas prices were prepared by the consultant and are based on FortisBC (Vancouver Island) rate sheet and FortisBC rate sheet as posted online at www.FortisBC.com. For Vancouver Island, an average rate, weighted by each rate class's energy sales in the 2010 Base Year

[11] $33.33/GJe.

resulted in an average rate of $0.0103 per MJ. For the Mainland, a weighted average of rates 2, 3, 5, 23, and 25 provided the non-interruptible rate. An interruptible rate of $0.006 per MJ was assumed, consistent with the July 1, 2010 FortisBC fixed price.

The industrial electricity cost is based on BC Hydro's Rate Schedule 1827, which is the blended rate for transmission-connected customers. Similar to the avoided cost of electricity, the annual demand charge of $67 per kW was the basis for an adjustment to the energy price at a load factor of 90%, bringing the cost of electricity for industrial customers to $0.041 per kWh.

Exhibit 24 Customer Energy Prices

	Industrial	
	Natural Gas $/GJ	Electricity $/GJ
Vancouver Island	$10.3	$11.4
Mainland Non-Interior	$7.1	$12.1
Mainland Interior	$6.0	$11.4

5.3 Technologies and Measure Assessment

Exhibit 25 lists the energy-efficiency technologies and measures that have been considered in this study. A description and detailed financial and economic assessment of each measure is provided in Appendix D.

Exhibit 25 Energy-efficiency Technologies and Measures Included in this Study

Conversion Device Upgrade Strategies

- Replace Unit Heater with Radiant Tube Heater
- Replace small standard efficiency boiler with condensing/near condensing boiler(Steady Load)
- Replace small standard efficiency boiler with condensing or near condensing boiler (Variable)
- Replace large standard efficiency steam boiler with near condensing boiler (Steady Load)
- Add Combustion Air Preheat to standard efficiency, steady load boiler
- Add Economizer to standard efficiency, steady load boiler
- Burner and Control Upgrades on Constant Load Standard Boiler
- Add Boiler Stack Condenser (Heat Recovery) to Large Steam Boiler
- Replace Standard Efficiency Baking Oven with High Efficiency Unit
- Replace Standard Efficiency Heat Treating Oven with High Efficiency Unit
- Add Ceramic Fiber Insulation for Constant Load Heat Treating Ovens
- Install Direct Fired Paper Drying Technology instead of Steam Heated Drums
- Burner and Control Upgrade to Pulp Lime Kilns
- Burner and Control Upgrade to Cement Kilns

Energy End Use Conservation Strategies

- Distribution System Insulation on Constant Process Load
- Optimized Heat Balance with Monitoring and Distribution System Control
- Steam Trap Maintenance Program
- Greenhouse Enclosure Upgrades (Energy Screens)

Unique Equipment Upgrades

- High Efficiency Lumber Dry Kilns
- High Efficiency Veneer Dryers
- Coal Centrifuge to reduce drying requirement
- Ore Dryer Upgrades (Copper Concentrate)
- Direct Fired Water Heating in Constant Process Load
- Direct Heat Upgrades – asphalt and gypsum
- Steam Cogeneration – Condensing Turbine

Cogeneration Options

- Install turbine generator on large steam system
- Install IC Engine Cogeneration device

5.3.1 Technology Screening Results

A partial summary of the results is provided in Exhibit 26. For each of the measures reviewed, the exhibit shows:

- End-use technology, applicable sub sectors and service areas
- The cost basis for the CCE that is shown, e.g., “full” versus “incremental”
- The simple payback in years and the total resource net benefits and the benefit-cost of the total resource cost.

Measures placed in Exhibit 26 have been ordered by customer payback period to provide a view of what customers could be expected to begin implementing. A measure that passes has positive TRC net benefits; on a full-cost basis it can be applied immediately, even if the piece of equipment that it replaces or improves is currently working properly. That means the rate at which the measure can be implemented as a utility DSM measure is limited by market and program constraints. A measure that passes only on an incremental basis, on the other hand, is limited by the rate of natural replacement (due to failure or obsolescence) or purchase of the piece of equipment it replaces.

Exhibit 26 Summary of TRC Measure Screening Results Industrial Sector Energy-efficiency Technologies

APPLICATION	MEASURE NAME	TECHNOLOGY	Full/ Incr	B/C Ratio	TRC Net Benefits ($,000)
Small Boilers	Efficient Boilers for Constant Annual Loads	2200 MBTU Output Near Condensing Boiler Standard Boiler Seasonal Efficiency = 68% New Boiler Seasonal Efficiency = 80%	I	16.1	247
Coal Dryers	Coal Drying	Conventional (Non-Vibrating) Fluid Bed Thermal Dryers with In-Bed Heat Exchangers	I	15.5	24,665
Boiler Related Upgrades	Add-on Condensing Heat Exchanger Large Boilers	Boiler Exhaust Stack Condensing Heat Exchanger add-on: 50,000 lbs/hour Standard Efficiency Boiler Baseline Efficiency = 68% Upgrade Efficiency = 83%	F	14.5	9,449
Boiler Related Upgrades	Distribution System Insulation	Distribution System Insulation Baseline Efficiency = 50% Upgrade Efficiency = 92%	F	13.1	105
Ore Dryers	Copper Concentrate	Optimize concentrate dryer	I	8.7	1,034
Boiler Related Upgrades	Efficiency Upgrades to a Constant Load Boilers	Boiler Advanced Control, Burner and Heat Recovery Bundle on a 2200 MBTU Standard Efficiency Boiler	F	7.6	218
Boiler Related Upgrades	Efficiency Upgrades to a Constant Load Boilers	Boiler Combustion Air Preheat on 2200 MBTU Output Standard Efficiency Boiler	F	7.6	26
Boiler Related Upgrades	Efficiency Upgrades to a Constant Load Boilers	Boiler Economizer on 2200 MBTU Output Standard Efficiency Boiler	F	7.6	26
Infrared Heaters	Direct-fired and Radiant Tube Heating (Variable Load)	Switch 3.3 MBTU Unit Heater to Direct-fired Heat Baseline Nat Gas Efficiency = 80% Upgrade Efficiency = 90%	I	7.6	114
Boiler Related Upgrades	Add-on Condensing Heat Exchanger Large Boilers	Boiler Exhaust Stack Condensing Heat Exchanger add-on: 50,000 lbs/hour Standard Efficiency Boiler Baseline Efficiency = 80% Upgrade Efficiency = 90%	F	7.5	4,545
Paper Drying	Direct Gas Fired Paper Drying	Convert To Direct-fired Paper Drying -Process Efficiency Increase = 7.3%	I	7.2	11,344
Small Boilers	Efficient Boilers for Variable Annual Loads	2200 MBTU Output Near Condensing Boiler Standard Boiler Seasonal Efficiency = 68% New Boiler Seasonal Efficiency = 80%	I	6.9	97
Small Boilers	Efficient Boilers for Constant Annual Loads	2200 MBTU Output Condensing Boiler Standard Boiler Seasonal Efficiency = 68% New Boiler Seasonal Efficiency = 92%	I	6.8	391
	Add Energy Screens to Greenhouse (Enclosure Upgrade)		F	5.5	881
Direct-fired	Asphalt Hot Mix Plant Upgrades	Upgrade Asphalt Hot Mix Plant Baseline Efficiency = 70% Upgrade Efficiency = 80%	F	5.4	655
Heat Treating	Heat Treating and Annealing Burner Upgrade	4000 MBTU Furnace with Sequential Firing, High Velocity Burners Baseline Efficiency = 25% Upgrade Efficiency = 40%	I	5.1	493
Ovens	High-efficiency Ovens	Change to 45 MBTU High-efficiency Oven Baseline Efficiency = 65% Upgrade Efficiency = 80%	I	5.1	3
Heat Treating	Heat Treating and Annealing Oven Insulation Upgrade	Ceramic Fibre Insulation on 4000 MBTU Furnace Baseline Efficiency = 25% Upgrade Efficiency = 40%	F	5.1	493
Small Boilers	Efficient Boilers for Constant Annual Loads	2200 MBTU Output Near Condensing Boiler Standard Boiler Seasonal Efficiency = 68% New Boiler Seasonal Efficiency = 80%	F	4.6	207
Infrared Heaters	Direct-fired and Radiant Tube Heating (Variable Load)	Switch 3.3 MBTU Unit Heater to Direct-fired Heat Baseline Nat Gas Efficiency = 80% Upgrade Efficiency = 90%	F	4.4	192
Small Boilers	Efficient Boilers for Constant Annual Loads	2200 MBTU Output Condensing Boiler Standard Boiler Seasonal Efficiency = 68% New Boiler Seasonal Efficiency = 92%	F	4.2	351
Process Water Heating	Direct Contact Hot Water Heating	Change to Direct-fired Water Heating (3200 MBTU Unit) Baseline Efficiency = 75% Upgrade Efficiency = 95%	I	3.4	273
Small Boilers	Efficient Boilers for Variable Annual Loads	2200 MBTU Output Condensing Boiler Standard Boiler Seasonal Efficiency = 68% New Boiler Seasonal Efficiency = 92%	I	2.9	129
Small Boilers	Efficient Boilers for Constant Annual Loads	2200 MBTU Output Condensing Boiler Near Condensing Boiler Seasonal Efficiency = 80% New Boiler Seasonal Efficiency = 92%	I	2.9	123
Boiler Related Upgrades	Efficiency Upgrades to a Constant Load Boilers	Boiler Advanced Control, Burner and Heat Recovery Bundle on a 2200 MBTU Output Near Condensing Boiler Baseline Boiler Efficiency = 80% New Boiler Efficiency = 92%	F	2.8	173
Boiler Related Upgrades	Efficiency Upgrades to a Constant Load Boilers	Burner and Control Upgrades on a Standard Efficiency Boiler (6% increase)	F	2.3	53
Small Boilers	Efficient Boilers for Variable Annual Loads	2200 MBTU Output Near Condensing Boiler Standard Boiler Seasonal Efficiency = 68% New Boiler Seasonal Efficiency = 80%	F	2.0	56
	Condensing Turbine	Condensing Turbine Added to improve control of existing steam system and to produce power	F	1.9	389,176
Process Water Heating	Direct Contact Hot Water Heating	Change to Direct-fired Water Heating (3200 MBTU Unit) Baseline Efficiency = 75% Upgrade Efficiency = 95%	F	1.9	184
Small Boilers	Efficient Boilers for Variable Annual Loads	2200 MBTU Output Condensing Boiler Standard Boiler Seasonal Efficiency = 68% New Boiler Seasonal Efficiency = 92%	F	1.8	89
Small Boilers	Efficient Boilers for Constant Annual Loads	2200 MBTU Output Condensing Boiler Near Condensing Boiler Seasonal Efficiency = 80% New Boiler Seasonal Efficiency = 92%	F	1.8	87
Small Boilers	Efficient Boilers for Variable Annual Loads	2200 MBTU Output Condensing Boiler Near Condensing Boiler Seasonal Efficiency = 80% New Boiler Seasonal Efficiency = 92%	I	1.3	18
Small Boilers	Efficient Boilers for Variable Annual Loads	2200 MBTU Output Condensing Boiler Near Condensing Boiler Seasonal Efficiency = 80% New Boiler Seasonal Efficiency = 92%	I	1.2	15
Small Boilers	Efficient Boilers for Variable Annual Loads	2200 MBTU Output Condensing Boiler Near Condensing Boiler Seasonal Efficiency = 80% New Boiler Seasonal Efficiency = 92%	F	0.8	-23
Small Boilers	Efficient Boilers for Variable Annual Loads	2200 MBTU Output Condensing Boiler Near Condensing Boiler Seasonal Efficiency = 80% New Boiler Seasonal Efficiency = 92%	F	0.8	-26

The TRC net benefits are calculated over the measure life of the technologies which ranges from 15 to 25 years. Selected highlights from Exhibit 26 are summarized below.

- Kiln upgrades are economically attractive at full cost for the pulp and paper and cement industries. Condensing boilers and stack condensers are all economic on a full cost basis. Direct-fired paper drying is economic on an incremental basis, i.e., it is economic to replace existing, standard efficiency equipment as soon as possible, and efficiency upgrades can be undertaken immediately.

- Efficient lumber dry kilns and veneer dryers are both economic on an incremental basis only.

- There are a number of other technologies that are economic but, due to their small market share, are not included in the results shown in Exhibit 26. These include economizers and air pre-heat for smaller boilers, efficient food processing ovens, and changes to direct-fired hot water heating.

5.4 Description of Energy-efficiency Technologies

Each of the technologies and measure shown in Exhibit 26 are briefly described below. In each case, the text provides the following:

- The current baseline technology
- A brief description of the upgrade technology
- The target sub sectors and process vintage(s) (new vs. existing) where the technology can be practically applied
- Information on the technology's energy performance and cost relative to the baseline technology
- A number of new technologies were added since the work plan list was developed because of the research that was done as a result of the interruptible customer survey
- If the technology has been dropped from further review since the list was developed for the work plan, a reason is given for doing so
- The expected useful life of the technology.

5.4.1 *Boilers*[12]

Boilers are used for steam or water heating in all sectors of manufacturing. Boilers make up 43% of the natural gas load in the Industrial sector, and a number of efficiency improvements are available.

Seasonal efficiency is used throughout the following discussion, as opposed to steady state boiler efficiency at full load. Seasonal boiler efficiencies for manufacturing range from 68% for a standard efficiency boiler to 92% for a condensing boiler. For Industrial sector retrofits, it is assumed that the installed cost is 2.5x the capital cost. Installed cost may be higher in the Industrial sector than for a comparable boiler size in the Commercial sector due to complexity of retrofits.

Energy-efficiency opportunities for boilers include:

- Near condensing boilers
- Condensing boilers
- Boiler economizers
- Boiler combustion pre-heating
- Advanced boiler controls

[12] Boiler technologies and economics based on personal communication with Kevin Woolley, Canadian Engineered Products, staff of Viessmann Manufacturing Company, Luc Mandeville of Sofame Technologies, and Greg Chapman of Chapman Burner.

- Low excess air burners
- Boiler heat recovery

Near Condensing Boilers

High-efficiency, near condensing boilers typically have a peak efficiency of 86%. A seasonal efficiency of 80% is assumed for this study. These boilers achieve high efficiency with advanced heat exchangers, modulating burner control, oxygen trim control systems, high quality insulation, and possibly a number of other features such as economizers, combustion air pre-heat, new combustion air fans and flue gas oxygen analyzers, low excess air burners and good insulation.

A simple payback period of four to five years is reported by vendors and in the literature for new installations of near condensing boilers over new installations of standard efficiency boilers. The useful life of these boilers is assumed to be 25 years. The average seasonal natural gas efficiency is assumed to increase from 68% for a standard boiler to 80% for a near condensing boiler.

Condensing Boilers

Condensing boilers have high-efficiency components such as modulating control and low excess air burners. They also have condensing heat exchangers that transfer heat from the exhaust flue gas to the return water. Condensing boilers need low return water temperatures (below 40°C) to operate at peak efficiency. If return water temperatures below 40°C cannot be provided, a condensing boiler will operate at efficiencies typical of a near condensing boiler. For this reason, although condensing boilers are economically attractive, they are not always feasible for the Industrial sector where technology growth is mostly in retrofit applications. The peak efficiency of condensing boilers can be as high as 97%. A seasonal efficiency of 92% is assumed for this study.

A simple payback period of between four and five years is reported by vendors and in the literature for new installations of condensing boilers over standard efficiency boilers. The useful life of a condensing boiler is 25 years. The average seasonal natural gas efficiency increase is assumed to be from 68% seasonal efficiency for a standard boiler to 92% seasonal efficiency for a condensing boiler.

Boiler Economizers

Economizers transfer waste heat from boiler exhaust gas to boiler feedwater or make-up water, thereby reducing the amount of heat that must be supplied by the fuel. High-efficiency, near condensing boilers usually have internal economizers and this technology is relatively common. Installing economizers on units that do not already have them is a practical and economical way of increasing energy efficiency and reducing the stack temperature only when installation costs are low. In retrofit applications, the cost of installing the economizer makes this technology economically unattractive for most applications. The useful life of economizers is 25 years. The average boiler efficiency increase by installing an economizer is approximated at 4% for either a standard boiler or a near condensing boiler.

Boiler Combustion Air Pre-heating

Boiler combustion air pre-heaters capture waste heat in the boiler flue gases, or from a hot building area to pre-heat the combustion air. This transfer reduces the amount of fuel needed to bring the air up to combustion temperature.

Note that since the combustion temperature will increase due to this practice, the NO_x emissions may increase if the burner design cannot accommodate the higher combustion air temperature. If this measure is to be promoted, acceptable NO_x levels must be maintained at all times.

A simple payback period of one year is reported by vendors and in the literature for installations of combustion air pre-heaters on standard efficiency boilers. The useful life of a pre-heat measure is 25 years. The average boiler efficiency increase by installing combustion air pre-heat is approximated at 4% for either a standard boiler or a near condensing boiler.

Controls and High-efficiency Burners (bundled standard upgrades)

Bundled standard boiler upgrades include advanced control and efficient burners. For this study, it is assumed that these upgrades are added as a bundle to a standard efficiency boiler, although it may be possible to add each technology individually.

Advanced boiler controls can lead to significant energy savings. Integrating the boiler control system with the process automation system allows for remote monitoring and changing of set points, and usually improves operation of the boiler system. Most advanced boiler controls include permitting higher turndown ratios than standard controllers. This contributes to energy efficiency by allowing the boiler to safely operate at a low firing rate.

Because perfect mixing between fuel and oxygen is never achieved, excess air is used to ensure complete combustion. Lowering the amount of excess air needed by the burner directly increases the fuel efficiency by reducing heat losses in the exhaust gas. A standard efficiency fire tube boiler usually operates at approximately 20% excess air. A low excess air natural gas burner may operate at as low as 10% excess air.

Oxides of nitrogen, collectively called NO_X, are formed during the high-temperature combustion conditions typical of low excess air burners. For that reason, high-efficiency burners are often also equipped with technology to reduce NO_X formation. The basic technology of low-NO_X burners usually involves carefully staged combustion and partial fuel premix, together with internal combustion gas recirculation. FortisBC will need to ensure that projects for burner upgrades or combustion air pre-heating do not adversely impact NO_x emission rates.

A simple payback period as low as 2.5 years is reported by vendors and in the literature for installations of condensation heat recovery on standard efficiency boilers. A payback this fast is likely only observed for processes with ideal conditions, such as a nearby heat sink with a heating load that is always higher than the amount of recovered heat. A more conservative value of three years is used in this study. The average natural gas efficiency increase is 6% over a standard efficiency boiler but only 2% for a near condensing boiler, because the boilers are typically designed with high-efficiency burners initially.

Large Boiler Replacement

There are a number of larger older wood waste steam boilers in pulp mills that could be replaced with more efficient fluidized bed units. There are also some large process boilers at food processors and other facilities that could be replaced with new more efficient units. In the 1980s and 1990s a number of these replacements occurred including units at Powell River, Port Alberni and Mackenzie. Over the last 10 years, due to low or no profit, these replacements have not been occurring. The capital cost is high and it is not practical to assume that a number of such boiler projects will occur. However, from an economic analysis perspective it is reasonable to assume that two large units in the Northern Interior could occur. An efficiency gain of about 10% would be likely for gas combustion, and 5% for wood combustion since the steam boilers would not be operating in the condensing regime.

Also it is likely that two older 50,000-lb/hr. gas-fired units in the Lower Mainland and one 50,000 lb/hr. gas-fired unit in the Southern Interior and another one on Vancouver Island could be replaced with more modern technology. An efficiency gain of about 10% would be likely since the steam boilers would not be operating in the condensing regime.

Addition of a Condensing Heat Exchanger to a Large Boiler

The addition of a condensation heat recovery unit to a boiler combustion stack recovers the latent heat of the flue gases for combustion air pre-heating and/or make-up water pre-heating. Essentially, this upgrade converts a standard boiler into a condensing boiler. The efficiency upgrade will be dependent on the temperature of the fluid that is circulated through the new condensing heat exchanger. This is an economic retrofit for processes that have a heat sink, such as significant boiler make-up water, or a significant domestic hot water load. Condensing heat recovery units require materials of construction that can withstand a corrosive environment, and newer heat exchangers have a useful life of more than 25 years. For this study, the addition of a condensing heat exchanger improves the efficiency of a standard boiler by 15%.

A simple payback period as low as 2.5 years is reported by vendors and in the literature for installations of condensation heat recovery on standard efficiency boilers. A payback this fast is likely only observed for processes with ideal conditions, such as a nearby low temperature heat requirement, and a large boiler with a high and consistent heating load.

5.4.2 *Direct-fired Water Heating*

Direct gas-fired water heaters have 95% or greater heat transfer efficiency. In one design, the combustion chamber is submersed in the water and the combustion gases are forced through the water, heating it by direct contact. This design is suitable for industrial applications with poor water quality, such as log or effluent ponds. In another design, cold water is sprayed downwards while combustion gases flow upwards. This design is appropriate for sanitary water applications such as laundries and food processing. This design is also used to heat boiler make-up water. No heat exchanger is needed with either design.

A simple payback period of three years is assumed for the installation of direct-fired water heaters over standard water heater heating using boilers. The useful life of direct-fired water heaters is assumed to be 15 years. The natural gas efficiency increase is assumed to be from a standard efficiency boiler of 68% to a direct-fired water heater seasonal efficiency of 95%.[13]

5.4.3 *Furnace Ceramic Fibre Insulation*

Direct gas-fired water heaters have 95% or greater heat transfer efficiency. In one design, the combustion chamber is submersed in the water and the combustion gases are forced through the water, heating it by direct contact. This design is suitable for industrial applications with poor water quality, such as log or effluent ponds. In another design, cold water is sprayed downwards while combustion gases flow upwards. This design is appropriate for sanitary water applications such as laundries and food processing. This design is also used to heat boiler make-up water. No heat exchanger is needed with either design.

A simple payback period of three years is assumed for the installation of direct-fired water heaters over standard water heater heating using boilers. The useful life of direct-fired water heaters is

[13] Direct-fired water heating economics and performance based on personal communication with Luc Mandeville, Sofame Technologies, and with Bill Carson, Direct Contact Inc.

assumed to be 15 years. The natural gas efficiency increase is assumed to be from a standard efficiency boiler of 68% to a direct-fired water heater seasonal efficiency of 95%.[14]

5.4.4 Direct-fired and Radiant Tube Heating

Direct-fired heating and radiant tube heating are both used in the Food & Beverage sector. Direct-fired heating is used in food processing and in poultry barns, and radiant tube heating is used in poultry barns. Direct-fired heating offers savings over boiler heat because it has higher natural gas efficiency; radiant tube heating offers savings over boiler heat because it allows poultry barns to operate at a lower overall temperature, while maintaining the same comfort levels for the animals.

A natural gas efficiency of 90% was assumed for direct-fired heating, and of 90% for radiant tube heating. A useful lifetime of 25 years is assumed for both of these technologies. A simple payback of three years is assumed for the installation of radiant tube heating or direct-fired heating over boiler heat.

Radiant tube heaters are a more efficient way to heat the large volume spaces typically found in the Industrial sector compared to air heating methods such as air handling units, unit heaters, and heat exchangers connected to the hot water or steam system.

Radiant tube heaters achieve the energy savings mainly because heat is radiated down to the floor space where the heat is needed, instead of trying to heat the large volume of air in an industrial building. An efficiency upgrade of 20% is used in this study when compared to an air handling unit, or make-up air unit. Industrial units are considered to have a life of 20 years.

5.4.5 Direct-fired Paper Drying

The Pulp and Paper sector that is the subject of this study primarily consists of board paper manufacturers and cellulose-based absorbent manufacturers. Traditionally, large industrial boilers provide steam to heat and dissolve the cellulose feedstock, and then to dry the final product after the cellulose is shaped into the form desired.

Drying board paper is usually accomplished by passing the sheet over steam-heated drums. However, the rate of drying is quite limited due to the low temperature of the steam. Therefore, the production rate of most paper machines is limited by slow rate of drying of the steam drums. As a result, the dryer section of a paper mill can be as large as a football field.

Various technologies have been developed to use natural gas to directly dry paper. Non-contacting infrared emitters have been developed to assist in moisture profiling of the sheet. The primary purpose of this technology is for moisture consistency, but it also allows the speed of the machine to be increased due to the additional drying capacity. Gas-heated dryer drums are the most common method of direct gas heating on paper machines. Overall thermal efficiencies can increase from 65% with steam to 90% with gas-heated dryer drum technology. The major benefit however is an increase in production of 15% due to the higher rate of drying. A board paper mill in Texas (Corrugated Services LP) recently installed both an infrared radiation dryer section and a gas-heated dryer drum on their corrugated board machine. They claim the fuel savings and increase in production due to these direct gas-heating technologies have provided significant economic benefits.

Total project costs of $1,500,000 were reported to add two gas-fired cylinders to a newsprint machine, with a resultant net revenue increase of $3,800,000 per year, much of it due to the

[14] Ibid.

increase in production rate. No change in maintenance costs is expected. For the smaller mills that are the subject of this study (about 10% the capacity of a newsprint machine), costing data was not available. It is assumed that a $1,000,000 investment will provide a 7.3% reduction in fuel usage per tonne of product, but will allow an increase in production of 16.7%, providing a simple payback of three years. The useful life of direct heated gas drying technologies is assumed to be 20 years.

Note that one of the pulp mills surveyed indicated that they are considering upgrading three existing paper dryers (with steam-heated drying drums) to direct-fired paper drying.

5.4.6 *Lime Kiln Upgrades*

The lime kiln operation in a Kraft pulp mill is one of the most challenging to control. First of all, it is a complicated mixed-phase chemical reaction process. Quickly moving combustion gases provide the heat input to chemically change the slowly moving solid-phase lime mud into lime.

Secondly, the many different types and degrees of process delays are very significant and difficult to manage manually. Adequate, but not optimum, manual control takes a well developed feel for the process and careful manual management of the individual control loop targets. In a process with such long time delays, it is common for operators to overreact to changes, resulting in long periods of instability and variable lime quality.[15]

It has been demonstrated in different facilities that the application of a sophisticated control system has resulted in significant savings. For the economic case analysis, a 4% savings on the natural gas used for lime kilns has been published. Paybacks for upgrading lime kilns are assumed to be nearly two years with gas at $6/GJ.

Adding insulation to a lime kiln also has a significant energy impact. A savings of 5% is achievable depending on the state of the existing kiln. Paybacks are assumed to be in the range of three years with gas at $6/GJ. BNZ Materials Ltd published a case history of two pulp lime kilns in Tennessee which achieved significant savings. A type of insulation called Marinite was installed between the refractory brick and shell when worn bricks were being replaced during regularly scheduled maintenance shutdowns.

5.4.7 *Distribution System Insulation*

This study considered insulating the boiler distribution system at partial and full levels. A standard pipe diameter of 2”, hot temperature of 82°C, and wind speed of five miles per hour were used for the calculations. A fully insulated distribution system was assumed to be insulated with mineral fibre to the economic thickness of one inch, and heat retaining efficiency of 92%, as per the North American Insulation Manufacturers Association (NAIMA) software 3E Plus. The baseline technology is a partially insulated distribution system, which is assumed to retain 50% of the heat lost in bare piping. The simple payback period for the installation of fully insulation was calculated to be 1.5 years, and a lifetime of 20 years, as per NAIMA.

A model typical facility was developed with a total pipe length of 815’ that could benefit from insulation. Standard heat loss values were used to calculate heat lost in the distribution system for partly and fully insulated pipe. It was assumed that in the Base Year, 75% of facilities would have partly insulated distribution systems, while the remaining 25% would have fully insulated distribution systems. Based on these assumptions, 4% of useful boiler heat was lost in the distribution system in the Base Year. Generally, any part of a heating distribution system above 50°C should be insulated.

[15] Heikki Imeläinen, Mauri Loukiala and Urpo Launonen. *Lime Kiln Optimization: Managing the Inputs to Stabilize The Outcome.*

5.4.8 *Large Process Steam Upgrades*

There are a number of facilities that involve large process steam networks, mainly at pulp mills, refineries and breweries. These systems involve distributing steam at a variety pressure levels: 200 kPa (29 psia[16]), 400 kPa (58 psia), and 750 kPa (109 psia) are examples. The steam is distributed to different end uses such as paper dryers, steam turbine drives, pulp chip digesters and space heating steam-heated fan coils.

All of these systems can be upgraded to a greater or lesser extent due mainly to equipment aging and due to the steam system network not being optimized with respect to process changes that have occurred. For example, some of the pulp mills are using steam turbines to drive fans or pumps and, due to deterioration, these drives are operating at a very low efficiency level. There are also situations where, due to process changes, higher pressures (750 kPa) are being used where lower pressures (200 kPa) would suffice.

Another common loss item is a deterioration of the condensate return system. At many of the end uses, after the energy in the steam is used, condensate (hot water in the order of 100°C) is available. The condensate return system captures this hot water and returns it to the boiler feedwater system. However, due to corrosion, in time these systems develop leaks and the hot water goes to the drain rather than being returned. The test to see how good the return system is the amount of make-up water required. In a theoretically perfect system no make-up water is required because all of the condensate is returned. Typically, if only 10% make-up water is required, the system is in excellent repair while a 30% make-up amount would indicate a system in poor shape.

Poor functioning steam traps are another loss item. A steam trap is a device used to discharge condensate and non-condensable gases with a negligible consumption or loss of live steam. Most steam traps are nothing more than automatic valves. They open, close or modulate automatically. Others are based on turbulent two-phase flows to obstruct the steam flow. In most large systems there are usually saving opportunities by repairing or replacing old poorly functioning traps.

Savings can be obtained in any large system at any time by conducting a detailed audit followed by repair and replacement of system components where required. However, the savings level will vary significantly from system to system depending on the existing state of repair and on the number of steam traps. FortisBC could facilitate capture of these savings by partially sponsoring detailed audit/upgrades of key systems. Savings from steam trap maintenance (and condensate return upgrades) are assumed to be in the order of 5%. Paybacks of two years are typical. On-going maintenance is required to maintain savings for this measure.

5.4.9 *Optimized Heat Balance with Monitoring and Distribution System Control*

Many industrial processes require heat to process materials into their final form. Examples include the conversion of wood into pulp and paper, hops into beer, and gas, oil and coal into plastics and pharmaceuticals. In each of these processes, different forms of heat and different temperatures may be required, such as high-temperature combustion gases, high- and low-pressure steam, and hot or warm water. In the late 1980s, with the rising cost of fuel and electricity, industries developed methods to decrease fuel requirements by capturing the waste heat from one process, and using that waste heat in another stage of the process. This was called “pinch” analysis and it provided the tools to analyze and optimize the recycling of heat within a plant to minimize the requirement for purchased energy. This process is also known as “process integration” and “heat of energy integration.” As analysis techniques developed, benefits went beyond energy conservation.

[16] The term “psia” means pounds per square inch absolute.

Pinch analysis considers an entire multi-step manufacturing process as one integrated process, permitting process optimization, resulting in improved product yield, decreased emissions, de-bottlenecking, improved flexibility and safety of the processes.

An example of the use of pinch analysis was presented in an article in *Innovation*, the monthly newsletter of the Professional Engineers and Geoscientists of BC, November 2002. A pinch analysis of a thermo-mechanical pulp mill operation in B.C. uncovered opportunities which resulted in the reduction in gas usage of 275,000 GJ/yr. of natural gas, with the potential for a further 155,000 GJ/yr. When completed, the mill may save $2.1 million per year in fuel costs, providing a seven-month payback on the expected $1.3 million capital cost. This example is not fully representative of a typical pinch case because the customer is much larger than the customer group which is the subject of this study, and because the savings resulted primarily from de-bottlenecking.

The Chemical, Pulp and Paper, and Food & Beverage processing sectors could potentially benefit from pinch technology. Pinch technology crosses over to all process streams within an operation, and the savings can be the result either low- or high-cost modifications to the mill. This study assumes that a plant-wide reduction in energy consumption of 10% is possible with an investment that would result in a four-year payback. This payback is an estimated average value. The application of pinch technology will increase maintenance requirements in some areas (e.g., additional heat exchangers may be required that will require maintenance), but will decrease maintenance in others (e.g., due to the increased efficiency, some heating units may actually be taken out of service). This study assumes no net change.

5.4.10 *Process Heat Recovery (Heat Exchangers and Storage)*

Further to the previous measure (Optimized Heat Balance), in most processes a great deal of waste heat is available that can be recovered and used. For example, breweries, sewage treatment plants, and pulp mills have warm effluent that can be used to pre-heat the incoming fluids through the use of a heat exchanger. This strategy is simple provided that the incoming flows are timed with the outgoing waste streams. If the timing is not concurrent, large storage tanks can be incorporated to store either the pre-heated incoming stream or the warm effluent until needed. This is a normal arrangement for pre-heating domestic water in many food industries from the refrigeration plant.

To further leverage heat recovery, a heat pump can be used to extract energy from the waste stream and heat the process stream to a greater degree. (Using a heat exchanger is called "passive heat recovery" and using a heat pump is called "active heat recovery.")

These strategies are most economic during new plant design, or major rework projects. Typical paybacks range from one to three years, depending on operating hours and the temperature difference between the waste stream and the process stream. Retrofit projects will have a longer payback, and higher capital cost because of the large amount of rework required. However some projects will exist with reasonable paybacks (two to four years) in energy-intensive industries that have long operating hours.

5.4.11 *Lumber Dry Kilns*[17]

- Advanced Dry Kiln Controls

Energy use in wood kiln drying is specific to operating conditions such as wood moisture content and species. Conventional heat and vent kilns are used in B.C. Larger sawmill operations use

[17] Dry kiln economics based on personal communication with Fred Spinola, General Manager, Coe Manufacturing, and Ken McClure, Sales and Marketing Manager, Wellons Canada.

natural gas, boiler-heated steam or thermal oil for kiln heating and significant amounts of electricity for fan power. Perhaps the most promising energy saving opportunity for conventional kilns is improved control. Most conventional kilns are operated on fixed time schedules. Computer controls with in-kiln moisture metering, fan speed control and vent control can offer significant energy savings. Replacing the old pneumatic controls with advanced control improves energy efficiency, drying time and final product quality.

The sawmill industry as a whole is moving away from natural gas and towards wood waste alternatives for heating dry kilns.

A simple payback period of two years is reported by vendors and in the literature for control upgrades to heat and vent kilns. The useful life of these control systems is 15 years. The average natural gas efficiency increase is assumed to be 30% for a standard kiln to 60% for a standard kiln with advanced controls. The average reduction in electricity consumption is assumed to be 15% following the installation of advanced controls.

- Efficient Dry Kilns

In addition to control systems, a number of upgrades are possible to turn an average kiln into an energy-efficient one. These upgrades include automatic venting, load balancing, insulation, baffling, variable speed drives and heat recovery.

An average simple payback period of four years is reported by vendors and in the literature for efficiency upgrades to heat and vent kilns. The useful life of the upgrades is 15 years. The average natural gas efficiency increase is assumed to increase from 57% for a standard kiln to 87% for an advanced kiln. The average reduction in electricity consumption is assumed to be 20% following the upgrades.

Based on the study team's knowledge, all the lumber kilns in operation are compartment or batch type kilns as opposed to progressive or continuous kilns. There has been considerable research conducted with respect to lumber drying, much of it involving continuous processes that utilize electric technologies such as microwave and radio frequency. However, to date these developments have not resulted in a commercially viable product.

Generally the improvements from the high-efficiency kilns are due to better airflow distribution, optimized airflow velocity and a reduction of energy losses due to better insulated and tighter kilns. The efficiency gain is then due to shorter drying times; the shorter the drying time the less energy that is used for thousand board feet of lumber dried. The temperature of the drying process does not change.

5.4.12 *High-efficiency Veneer Dryers*

Veneer dryers can also be heated with natural gas, steam or thermal oil at plywood plants.

Veneer dryers operate as a continuous process with multiple lines of veneer. Temperatures are between 350°C and 400°C and the chamber is pressurized. Veneer dryers are either direct natural gas-fired or indirectly heated with thermal oil or steam from a natural gas or wood waste-fired boiler. The largest efficiency and production improvement opportunity for veneer dryers is upgrading insulation and seals. As with lumber dry kilns, the plywood sector is moving away from natural gas as a heat source and towards wood waste.

A simple payback period of three years is reported by vendors and in the literature for upgrades to veneer dryers. The useful life of a veneer dryer upgrade is 15 years. A reduction in natural gas consumption of up to 40% is reported for some veneer dryer upgrades, but a more conservative value of 20% is used in this study. The natural gas efficiency is assumed to increase from 50% for a standard veneer dryer to 70% for an efficient veneer dryer.[18]

5.4.13 Greenhouse Enclosure Upgrades

Natural gas boilers are used to heat many greenhouses. Much of the heating is required due to heat loss from the greenhouse during the night hours. Energy screens (essentially retractable blankets that let a portion of the light through) are available that can reduce heat loss by up to 25%. Many newer greenhouses are installing these types of screens for heat and light control. For this analysis, a conservative estimate of savings was used at 17% for a new energy screen installation.

5.4.14 Ore Drying

- Coal Drying

It is assumed that the existing coal dryers being used are the conventional rotary flash dryer type. It was assumed that the efficiency of these units could be improved by 10% through improved combustion control and heat recovery. Also centrifuges that spin the coal at high speeds to drive off moisture prior to entering the dryer is an option for reducing the drying load on the coal dryers. For this analysis, a 10% energy savings was used with a payback of three years using $6/GJ gas.

- Copper Concentrate

At a number of copper mining operations wet copper concentrate is dried in large rotary kilns. The dryers use natural gas to produce hot combustion gases that are blown into the dryer. The gases should be as hot as possible to maximize thermal efficiency, but must not exceed the ignition temperature of the metal sulfide copper concentrates.

It was assumed that improved control measures could improve the efficiency by 5%. A Reference Case from the Kennecott Utah Copper mine demonstrated this savings level is feasible, with a payback of two years using $6/GJ gas.

5.4.15 Heat Treating and Annealing

Heat treating and annealing are used primarily in the Fabricated Metal sub sector. Fuel efficiency measures investigated are improved burner design, heat recovery and improved insulation.

Sequential Firing, High-velocity Burners

Sequential firing occurs when multiple burners are fired cyclically at full power. This creates a very agitated atmosphere within the furnace, increasing turbulence, and thereby increasing heat transfer by convection. An added benefit of pulse firing is that a consistent temperature can be achieved within the furnace with variations as low as 4°C.

High-velocity burners are a type of nozzle mix burner with burner velocity up to 150 m/sec. They provide deep penetration of heat into the stock, good rates of heat transfer and uniform temperature distribution in a furnace.

For the purpose of this study, it is assumed that sequential firing, high-velocity burners are added as a bundle to standard efficiency heat treating furnaces.

[18] Veneer dryer performance based on personal communication with Dave Chard, Westmill Industries.

A simple payback period of three years is reported by vendors and in the literature for new installations of sequential firing, high-velocity burners over standard burners. The useful life of these technologies is assumed to be 15 years. The average natural gas efficiency increase from a standard burner efficiency of 25% to an upgraded burner efficiency is 40%. For high-temperature applications such as heat treating, efficiency is typically low, and is defined as the heat that is transferred from the flame to the metal. Paybacks of three years are typical for the incremental cost when replacing the equipment.

5.4.16 High-efficiency Ovens

High-efficiency ovens are found in the Food & Beverage sub sector.

A simple payback period of three years is reported by vendors and in the literature for new installations of high-efficiency ovens over standard ovens. The useful life of high-efficiency ovens is 15 years. The average natural gas efficiency increase is from 65% for a standard oven to 80% for an efficient oven.[19]

5.4.17 Direct Heat – Asphalt and Gypsum

Natural gas is used in the asphalt to dry and heat aggregate and heat the asphalt in preparation for mixing. Plant design is varied, and both continuous or batch type processes are used. Literature indicates that in Canadian plants efficiency varies by 20% from plant to plant. Due to the varying nature of these plants, it is likely that most efficiency gains can be made by replacement of more modern plants, however, a modest efficiency gain of 10% is likely through burner upgrades, improved controls and insulation. For the economic case, a 10% improvement potential was assumed, using a payback of three years.

The process to manufacture drywall from gypsum requires direct-fired natural gas heat to dry the product. Based on information from the manufacturers, a 9% efficiency improvement is obtainable, bringing average efficiency up from 81% to 90%, which is in line with industry best practice. A payback of three years is used since the upgrades are deemed economical from the companies' perspective.

5.4.18 Cogeneration

Cogeneration, the simultaneous production of electricity and useful heat, is generally considered an efficiency technology because it is a much more efficient method for generating electricity than from a gas-fired electric utility plant. However, with respect to an application at a specific customer site, it does result in additional natural gas being used.

- Internal Combustion Engines

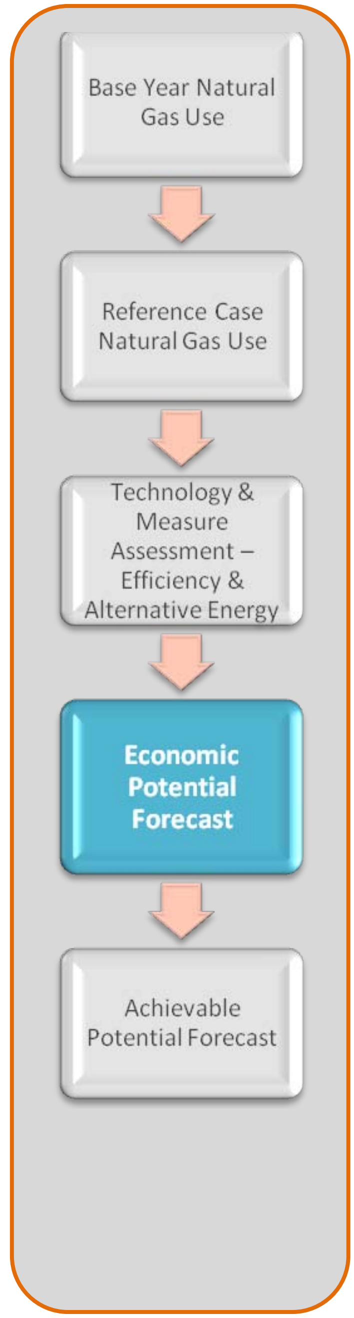
There is a significant opportunity for cogeneration in the greenhouse industry using natural gas-fired reciprocating engines. One greenhouse in B.C. already has a small operating internal combustion cogeneration engine that sells electricity back to BC Hydro, and recovers the waste heat to the greenhouse. The barriers to the more widespread application are the uncertainty as to the long-term cost of natural gas and, now, the carbon tax.

A method for overcoming these barriers is to use "green gas," as is the case with cogeneration unit at one greenhouse complex in the Lower Mainland. For this particular project, landfill gas is used. No value was assigned to this measure in the economic case analysis.

[19] Oven economics and heat savings based on personal communication with Revent Oven of New Jersey, USA.

6 Economic Potential Forecast

6.1 Introduction



This section presents the Industrial sector Economic Potential Forecast for the study period 2010 go 2030. The Economic Potential Forecast estimates the level of energy consumption that would occur if all equipment and processes were upgraded to the level that is cost effective. In this study, "cost effective" means that the technology upgrade passes the measure TRC test, as discussed previously in Section 5.

The discussion in this section is organized and presented in the following subsections:

- Major modeling tasks
- Technologies included in Economic Potential Forecast
- Presentation of results
- Interpretation of results.

6.2 Major Modelling Tasks

By comparing the results of the Industrial sector Economic Potential Forecast with the Reference Case, it is possible to determine the aggregate level of potential natural gas savings within the Industrial sector and to identify specific sub sectors and technologies that provide the most significant opportunities for savings. To develop the Industrial sector Economic Potential Forecast, the following tasks were undertaken:

- The results of the energy-efficiency measures screening, which were presented in the preceding Section 5, were reviewed. All the natural gas energy-efficiency upgrades that passed the measure TRC screening were included in this Economic Potential Forecast.

- New equipment measures meeting the screen on a full cost basis were "installed" at equipment annual turnover rates. Screened efficiency improvement bundles (e.g., optimization and controls) were installed in the first study year (2011). The conversion device efficiency and process efficiency for each technology/measure was updated for the sub sectors within each service area.

- The model calculated the change in market share for the screened technologies and measures based on the results of preceding task. The Reference Case energy consumption forecast was updated with the changes in technology/measure market share to produce the Economic Potential Forecast.

- The difference between the Economic Potential Forecast consumption and the Reference Case was calculated, to produce the Economic Potential savings.

6.3 Technologies Included in Economic Potential Forecast

The technologies presented in this energy-efficiency Economic Potential Forecast can be grouped into three main categories:

- Gas conversion devices (equipment) that are available in high(er) efficiency models as well as standard efficiency ones
- "Add-on" technologies, such as insulation or operating controls that reduce overall gas purchases but do not consume gas themselves
- Gas-consuming technologies where there is no practical upgrade.

A brief discussion of the approach to each of the above technology categories is outlined below.

6.3.1 *Conversion Devices with High-efficiency Models*

Most of the natural gas technologies in this analysis fall into this category. As briefly outlined in the preceding section, this analysis introduces the more efficient technologies into the Economic Potential Forecast model in one of two ways: on an incremental basis or on a full-cost basis.

The incremental basis was applied to those technologies where it is only economic to replace a standard unit with an efficient unit at the end of the standard unit's useful life. In this case, the market share of the efficient technology grows at the rate of stock replacement. The rate of stock replacement is calculated based on the technology's average useful life and the original installed stock of the technology being replaced. For the Economic Potential Forecast, it was assumed that replacement would be considered starting when the unit reached of the end of its useful life, and replacement would occur at the time if it were economic to do so.

The full-cost basis was applied to those technologies where it is economic to replace an existing standard model with an efficient model before the end of the standard unit's useful life. In this case, all standard models are replaced by the first milestone year. Unless otherwise noted, it is assumed that technologies are not interchangeable (e.g., an efficient boiler can replace a standard boiler but cannot replace a rooftop air handling unit).

6.3.2 *"Add-on" Technologies*

Some technologies, such as insulation or operating controls can reduce overall gas purchases. While these technologies do not consume gas themselves, not having them installed results in increased gas consumption. As with the higher efficiency models case, either the technology was applied immediately (full cost), or when the end of life is reached depending on if the measure was deemed economical

6.3.3 *"No Option" Technologies*

Some technologies that have market share have no practical efficiency upgrade. These technologies either have an efficient model that is not economically attractive, or are only available in one efficiency level. Although this analysis does not identify conservation potential for these technologies, they are included in the results because they have a market share of the heat sold.

Further discussion of the efficient equipment and process improvements selected for inclusion in the Economic Potential Forecast are presented in Exhibit 27. In each case, the exhibit shows:

- Energy end use
- Upgrade technology(s) selected
- Brief explanation of applicable sub sectors and the rate at which the technology is introduced into the Economic Potential Forecast.

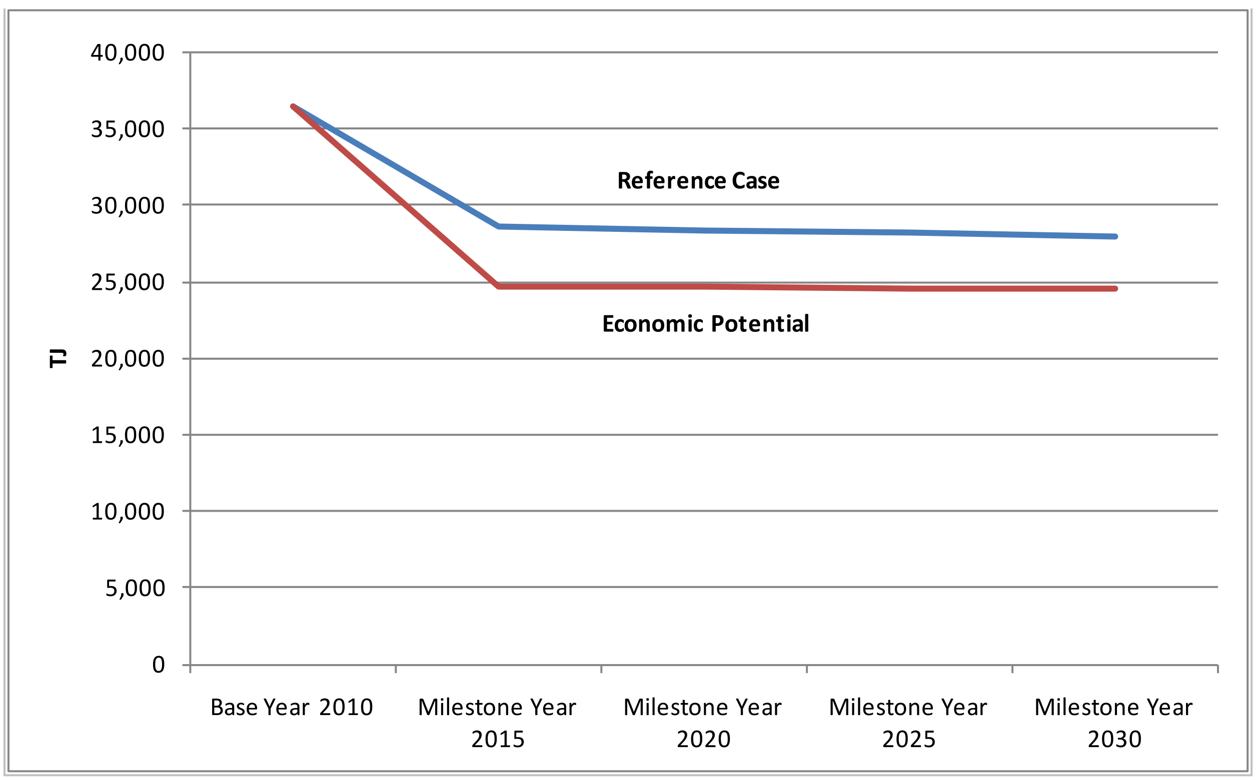
6.4 Presentation of Results

Exhibit 27 compares the Industrial sector consumption results from the Reference Case to those in the Economic Potential Forecast.

As illustrated, under the Reference Case, Industrial sector natural gas use would decrease from the Base Year level of about 36,500,000 GJ/yr. to approximately 28,000,000 GJ/yr. by 2030. This contrasts with the Economic Potential Forecast in which natural gas use would decrease to approximately 24,500,000 GJ/yr. by 2030 for an annual reduction of 3,400,000 GJ, or just over 14% of the Reference Case for 2030. This is in addition to the 22% load reduction for the study period (2010 to 2030) included in the Reference Case.

Exhibit 27 Reference Case versus Economic Potential Forecast

—Annual Industrial Natural Gas Consumption (TJ)



6.4.1 *Natural Gas Savings*

Further details on the potential energy savings provided by the Economic Potential Forecast are provided in the following exhibits:

- Exhibit 28 presents the results by service region and milestone year
- Exhibit 29 presents the results by sub sector and milestone year
- Exhibit 30 presents the results by major end use.

Exhibit 28 Total Economic Potential Natural Gas Annual Savings (GJ)

Milestone Year	Lower Mainland	Northern Interior	Southern Interior	Vancouver Island	Total	Economic Savings over Reverence Case
2015	2,014,970	1,020,350	722,532	126,446	**3,884,297**	16%
2030	1,911,392	985,354	701,401	120,991	**3,719,138**	15%
2025	1,825,772	951,448	680,790	116,885	**3,574,896**	15%
2030	1,748,002	918,667	660,731	111,907	**3,439,307**	14%
2030 Percent Savings Over Reference Case	15%	12%	15%	18%	14%	

Exhibit 29 Total Economic Potential Natural Gas Annual Savings

- by Sub Sector and Milestone Year (GJ)

Sub Sector	2015	2020	2025	2030
Agriculture	419,252	374,778	336,858	303,481
Chemical	364,678	360,665	356,965	353,565
Fabricated Metal	195,323	180,337	165,385	151,767
Food & Beverage	807,873	791,578	776,124	761,523
Mining	357,879	350,639	343,400	336,175
Miscellaneous Manufacturing	17,051	18,741	20,116	21,215
Non-Metal Manufacturing	243,039	225,140	208,594	193,293
Other	101,214	95,175	89,538	84,277
Pulp and Paper	831,025	788,092	758,270	729,930
Wood Products	546,962	533,993	519,646	504,082
Total	**3,884,297**	**3,719,138**	**3,574,896**	**3,439,307**

Exhibit 30 Total Economic Potential Natural Gas Annual Savings over Reference Case - by Major Technology and End Use (GJ)

Technology	2030 Savings	Technology Share
Boilers	1,938,475	56%
Air heating	474,596	14%
Lumber kilns	339,137	10%
Direct fired	219,840	6%
Coal drying	155,621	5%
Heat treating	94,455	3%
Pulp lime kilns	75,180	2%
Veneer dryers	51,326	1%
Cement kilns	48,129	1%
Ovens	27,773	1%
Ore drying	7,410	<0.1%
Water heaters	7,365	<0.1%
Total	**3,439,307**	100%

Detailed results are presented in Appendix D by sub sector, service area, end use and technology.

6.5 Interpretation of Results

Highlights of the results presented in the preceding exhibits are summarized below.

Savings by Industrial Sub Sector

- The Food & Beverage sub sector has the largest potential for efficiency upgrades at 22% of the total Economic Potential, closely followed by the Pulp and Paper sub sector at 21%, and the Wood Products sub sector at 15%. Chemical and Mining both make up 10% of the potential each, while the other sub sectors have more minor potentials.

Savings by Technology

- The dominant technologies throughout the Industrial sector are the boilers, showing the greatest savings potential at 56% of the total Economic Potential. As illustrated in Exhibit 30, improved efficiency boiler equipment in all applicable sub sectors offers approximately 1,938,000 GJ/yr. of process heat savings potential by 2030. These savings come from a range of boiler equipment upgrades including boiler replacement, add-on condensing units, and controls, as well as with heat recovery and controls for the process.

- Air heating (for comfort) makes up the second largest Economic Potential at 14%. This is due to the large number of smaller manufacturers who heat their industrial spaces with inefficient unit heaters or air handling units. Radiant tube heaters are an attractive option in high-bay buildings in the Industrial sector, especially near large doors that may be open for significant time periods during the day.

Savings by Service Area

- The Lower Mainland comprises 57% of the Economic Potential, while accounting for 48% of total Industrial sector Base Year sales. These results are explained by the large savings potential of boiler upgrades and replacement in the Food & Beverage sub sector located in the Lower Mainland.

- The Northern Interior's portion is approximately 25% of the Economic Potential, while the Southern Interior is at approximately 14%, reflecting the reduction of wood manufacturing capacity in the area.

- Vancouver Island makes up both a small part of Base Year sales, and a small part of the Economic Potential (approximately 2%).

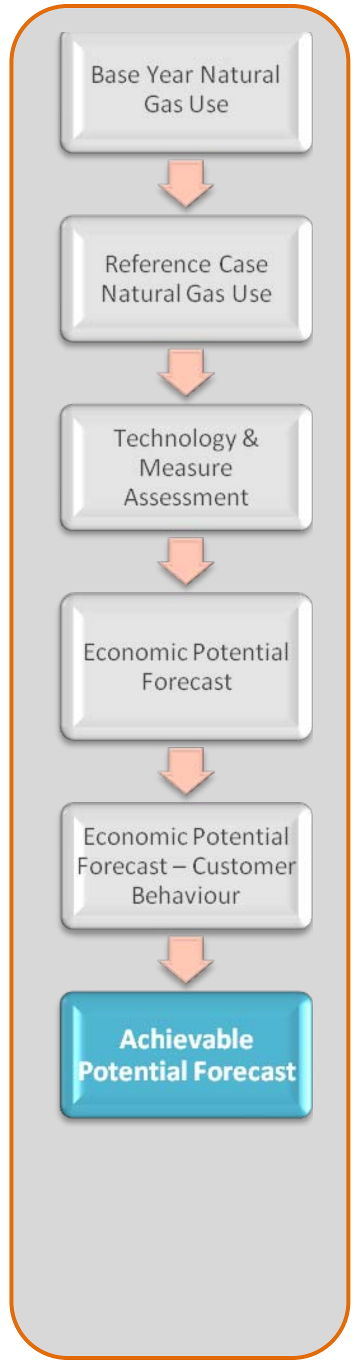
Savings by Milestone Year

- Exhibit 30 shows that in the Reference Case, annual gas consumption declines according to the forecast reduction in natural gas sales over the study period for the Industrial sector. The reduction is due to expected slowdown in manufacturing and industrial output in the first milestone period to 2015. After 2015, the rate of decline is approximately 1.5 % per milestone period.

- In the Economic Potential Forecast, gas consumption declines at a greater rate than the Reference Case up to the first milestone year (2015). Sales consumption continues to decline through each of the milestone years at approximately 7% per period. The captured savings rate reflects the increased market share of high-efficiency technologies and equipment upgrades.

7 Achievable Potential Forecast

7.1 Introduction



This section presents the Industrial sector Achievable Potential for the study period (2010 to 2030). The Achievable Potential is defined as the proportion of the energy-efficiency opportunities identified in the Economic Potential Forecast that could realistically be achieved within the study period.

The remainder of this discussion is organized into the following subsections:

- Description of Achievable Potential
- Approach to the estimation of Achievable Potential
- Results – energy-efficient technologies.

7.2 Description of Achievable Potential

Achievable Potential recognizes that, in many instances, it is difficult to induce all customers to purchase and install all the energy-efficiency technologies that meet the criteria defined by the Economic Potential Forecast. For example, customer decisions to implement energy-efficient measures can be constrained by a number of factors. The rate at which customers accept and purchase energy-efficiency products will be influenced by the level of financial incentives, information and other measures put in place by FortisBC, BC Hydro, governments and the private sector to remove barriers such as those noted above.

Exhibit 31 presents the levels of natural gas consumption that are estimated in the Achievable Potential scenario. As illustrated, the Achievable Potential scenarios are *banded* by the two forecasts presented in previous sections: the Economic Potential Forecast and the Reference Case.

As illustrated in Exhibit 31 energy savings under the Achievable Potential scenario are less than in the Economic Potential Forecast. In this CPR, the primary factor that contributes to the outcome shown in Exhibit 31 is the rate of market penetration. In the Economic Potential Forecast, efficient new technologies are assumed to fully penetrate the market as soon as it is economically attractive to do so. However, the Achievable Potential recognizes that under real world conditions, the rate at which customers are likely to implement new technologies will be influenced by additional practical considerations and will, therefore, occur at a rate less than that under the assumptions employed in the Economic Potential Forecast.

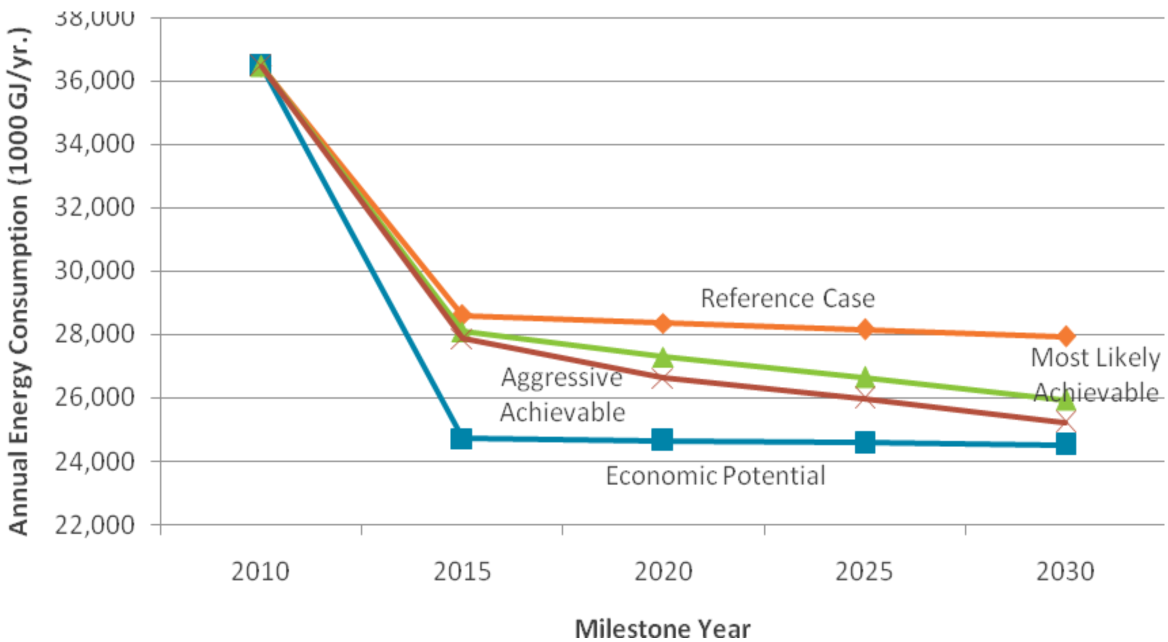
The following are examples of the additional considerations:

- Customers often do not have sufficient in-house technical staff to be able to perform the up-front site-specific engineering work that needs to be performed before an energy-efficiency project can be implemented.
- The particularly facility involved may have an uncertain future due to market conditions, which affects the demand for the product being produced. For example, over the last few years a number of pulp mills have shut down due to continually decreasing demand for

paper. If there is uncertainty as to the future of a particular mill, a new boiler cannot be financially justified.

- In some cases, the technical personnel are not familiar enough with a particular efficiency technology to risk replacing an existing reliable, but inefficient, piece of equipment with a more efficient unit.

Exhibit 31 Annual Natural Gas Consumption — Energy-efficiency Achievable Potential Relative to Reference Case and Economic Potential Forecast for the Industrial Sector, (GJ/yr.)



As also illustrated in Exhibit 31, the Achievable results are presented as a band of possibilities, rather than a single line. This is because any estimate of Achievable Potential over a 20-year period is necessarily subject to uncertainty. Consequently, two Achievable Potential scenarios are presented: most likely and aggressive.

The **most Likely Achievable Potential** assumes B.C. market conditions that are similar to those contained in the Reference Case. That is, the customers' awareness of energy-efficiency options and their motivation levels remain similar to those in the recent past, technology improvements continue at historical levels, and new energy performance standards continue as per current known schedules. It also assumes that FortisBC's ability to influence customers' decisions towards increased investments in energy-efficiency options remain roughly in line with previous company DSM experience.

The **aggressive Marketing Achievable Potential** assumes that B.C. market conditions become more supportive of investing in energy efficiency. For example, this scenario assumes that real energy prices increase over the study period. It also assumes that federal and provincial government actions to mitigate climate change result in increased levels of complementary energy-efficiency initiatives. Aggressive Achievable Potential typically does not reach Economic Potential levels; this recognizes that some portion of the market is typically constrained by barriers that cannot realistically be affected by DSM programs within the study period.

Typically, the barriers are as follows:

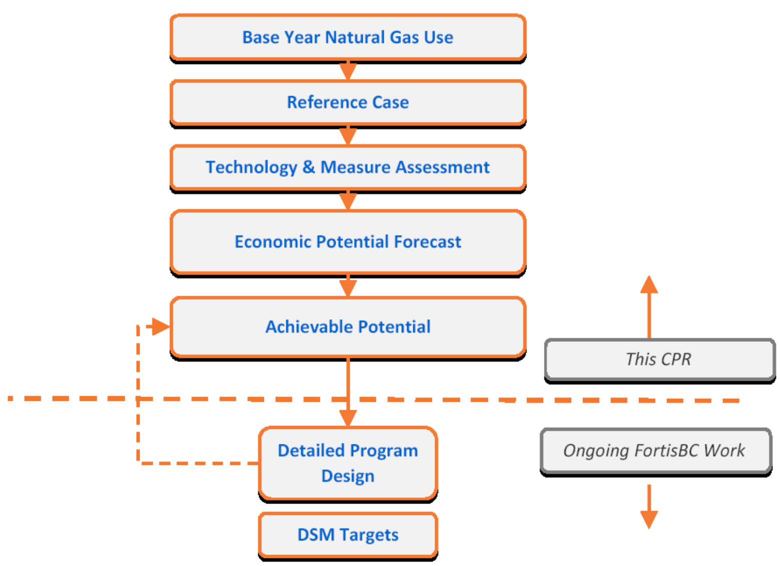
- Availability of technical assistance or resources to perform the site-specific engineering work
- Uncertain economic viability of a particular site
- Unwilling to take the risk of replacing equipment that is working reliably even though there is more efficient equipment available
- A particular efficiency technology may be available in other jurisdictions but is not readily available here in terms of suppliers who will look after installation and provide ongoing servicing and spare parts
- Customers are simply unaware that a more efficient technology is available.

7.2.1 Achievable Potential versus Detailed Program Design

It should also be emphasized that the estimation of Achievable Potential is not synonymous with either the setting of specific program targets or with program design. While both are closely linked to the discussion of Achievable Potential, they involve more detailed analysis that is beyond the scope of this study.

Exhibit 32 illustrates the relationship between Achievable Potential and the more detailed program design.

Exhibit 32 Achievable Potential versus Detailed Program Design



7.3 Approach to the Estimation of Achievable Potential

Achievable Potential was estimated in a five-step approach.

- Priority opportunities were selected
- Opportunity profiles were created
- Opportunity worksheets were created
- A full-day workshop was held to gain input from stakeholders
- Workshop results were aggregated and applied to the remaining opportunities.

Further discussion is provided below.

7.3.1 Step 1 Select Priority Opportunities

The first step in developing the Achievable Potential estimates required selection of the energy saving opportunities identified in the Economic Potential Forecasts to be discussed during the Achievable workshop. Several criteria determined selection, including:

- The priority measures should represent a substantial fraction of the overall Economic Potential
- The priority measures should represent sufficient energy end uses applicable across Industrial sub sectors
- The priority measures should have a variety of different likely patterns of market adoption, so the discussions will be widely varied.

A summary of the selected energy-efficiency actions, along with the approximate percentage that each represents in the Economic Potential, is provided in Exhibit 33.

Exhibit 33 Industrial Sector Actions – Energy Efficiency

Measure	End Use	2030 Economic Savings Share (%)
Efficient boiler systems	Boilers	57%
Radiant tube heating	Air heating	14%
High-efficiency kiln	Lumber kiln	10%
Advanced veneer dryer	Veneer dryers	1%
High-efficiency kiln	Pulp lime kiln	2%
High-efficiency coal and ore dryers	Coal and ore drying	5%
Direct-fired heating	Direct fired	6%
Grand Total		95%

7.3.2 Step 2 Create Opportunity Profiles

The next step involved the development of brief profiles for each of the opportunities noted above in Exhibit 33. The profiles are presented in Appendix E.

The purpose of the opportunity profiles was to provide a high-level logic framework that would serve as a guide for participant discussions in the Achievable workshop (see Section 7.3.4 below). The intent was to define a broad rationale and direction without getting into the much greater detail required of program design exercise, which, as noted previously, is beyond the scope of this project. As illustrated in Appendix E, each opportunity profile addresses the following areas:

Technology Description – provides a summary statement of the broad goal and rationale for the action.

Target Energy End Uses for Industrial Sub Sectors – highlights the technology improvements offering the most significant opportunities for each Industrial sector end use, and which provide a good starting point for discussion of the technology.

Financial and Economic Indicators – provides estimates of average simple payback, benefit-cost ratio (TRC analysis), and basis of assessment (full cost versus incremental).

Eligible Projects – provides an estimate of the number of equipment/system upgrades that could be affected during the study period if the entire Economic Potential were to be captured.

Economic Potential versus Time – shows the pattern of the changing size of the opportunity over the study period for each of the end-use technologies. Some opportunities grow steadily through the study period, as equipment reach replacement age. Other opportunities are economic to capture immediately, and after that the growth over time is limited to what would be new industrial loads coming onto the system. Still other opportunities decline with time as they are eroded by natural conservation activities.

Economic Potential versus Industrial Sub Sector and Region – shows how the opportunity is distributed through FortisBC's service territory.

7.3.3 Step 3 Prepare Opportunity Worksheets

A draft assessment worksheet was prepared for each opportunity profile in advance of the Achievable workshop. The assessment worksheets complemented the information contained in the Economic Potential model output by providing quantitative data on the potential energy savings for each opportunity as well as providing information on the size and distribution of potential equipment replacement/upgrade projects. Energy impacts and population data were taken from the detailed modelling results contained in the Economic Potential Forecast.

The worksheets, including the results recorded during the workshop discussions, are provided in Appendix E. As illustrated in Appendix E, each opportunity assessment worksheet addresses the following areas:

Approximate Benefit-Cost Ratio – shows the approximate ratio of economic benefits to costs. The benefit-cost ratio provides an indication of the relative economic attractiveness of the energy-efficiency measures from FortisBC's perspective. For the purposes of the workshop, this information provided participants with an indication of the scope for using financial incentives to influence customer participation rates.

Customer Payback – shows the simple payback from the customer's perspective for the package of energy-efficiency measures included in the opportunity. This information provided an indication of the level of attractiveness that the opportunity would present to customers. This provided an important reference point for the workshop participants when considering potential participation rates. When combined with the preceding benefit-cost information, participants were able to roughly estimate the level of financial incentives that could be employed to increase the opportunity's attractiveness to customers without making it economically unattractive to FortisBC.

Economic Potential in Terms of Applicable Upgrades/Replacement Projects (e.g., number of boilers replaced) — shows the total number of potential upgrades/projects in terms of either energy end use or technology (as appropriate) that could theoretically take part in the opportunity. Numbers shown are from the efficiency improvements in the Economic Potential Forecasts.

Participation Rates (%) – these fields were filled in during the workshops (described below in the following step), based on input from the participants. They show the percentage of economic savings that workshop participants concluded could be achievable in the last milestone period (usually 2030, but may be earlier for measures that peak earlier). As noted in the introduction to this section, two Achievable levels are shown: *most likely* and *aggressive*. For example, Exhibit 40 shows a savings capture rate of 29% (most likely) for high-efficiency lumber kilns in sawmills by the year 2030. This means that an estimated 29% of the upgrades/replacements for lumber kilns in that year would be to high-efficiency kilns under a most likely level of program activity. Under the comments column, participants indicated a likely shape for a curve to describe how quickly activity would rise to that level so that participation rates for the intervening milestone years could be estimated. The different curves are described below.

Achievable Potential in Terms of Economic Upgrades/Replacement to Equipment (e.g., number of boilers) **—** these fields were calculated by the spreadsheet based on the participation rates provided by the participants.

Participation Rates Relative to the Discussion Scenario – these fields were filled in during the workshop to provide guidance to the consulting team on how participation might differ in other regions.

Other Parameters – these fields were filled in during the workshop to capture other aspects of the discussion.

7.3.4 Step 4 Achievable Workshop

The most critical step in developing the estimates of Achievable Potential was a half-day Achievable Potential workshop that was held on January 27, 2011. Workshop participants consisted of core members of the consultant team, DSM program and technical personnel from FortisBC, and a Ministry of Energy Mines and Petroleum Resources representative. Together, the participating personnel brought years of experience to the workshop related to industrial energy use and practices, preferred technologies, and the needs of industry in B.C. to remain competitive.

The purpose of this workshop was to:

- Promote discussion regarding the technical and market constraints confronting the identified energy-efficiency opportunities
- Identify potential strategies for addressing the identified constraints, including potential partners and delivery channels
- Compile participant views related to how much of the identified economic savings could realistically be achieved over the study period.

The discussion of each opportunity profile began with a brief consultant presentation. The floor was then opened to participant discussion of the key factors affecting each of the market segments and technical opportunities contained in the opportunity profile and accompanying worksheet.

Following discussion of the broad market and intervention conditions affecting the opportunity, workshop participant views were recorded on the most likely and aggressive customer participation rates. General agreement was sought on participation levels to be carried forward into the analysis.

As noted earlier, the half-day workshop did not address all efficient technologies captured in the Economic Potential. Consequently, the workshop focused on opportunities selected based on the criteria described in Step 1. For the most part, it was possible to apply the Achievable savings rates to those remaining end uses not presented. The values shown in the attached appendices and in the following summary tables incorporate the results of all these inputs.

7.3.5 Step 5 Aggregate Opportunity Results

The final step involved aggregating the results of the individual opportunities to provide a view of the Achievable Potential savings for the total Industrial sector.

7.4 Results – Efficiency Technologies

A summary of the most likely and aggressive Achievable Potential results for the energy-efficiency opportunities is presented in this section. These results include the following:

- Natural gas consumption savings
- Peak day load impacts
- Greenhouse gas emission reductions.

7.4.1 *Natural Gas Consumption Savings – Aggressive Achievable Scenario*

The following exhibits present the potential natural gas savings under the aggressive Achievable Potential scenario. The results shown are relative to the Reference Case. The results are broken down as follows:

- Exhibit 34 presents the results for the total FortisBC service territory by service region and milestone year.
- Exhibit 35 presents the results for the total FortisBC service territory by sub sector and milestone year.
- Exhibit 36 presents the results for the total FortisBC service territory by end use and milestone year.
- Exhibit 37 presents the results for the total FortisBC service territory by technology and milestone year.

Exhibit 34 Aggressive Achievable Natural Gas Savings by Service Region and Milestone Year (GJ/yr.)

Year	Lower Mainland	Northern Interior	Southern Interior	Vancouver Island	Grand Total	Savings Share of 2030 Reference Consumption
2015	350,187	180,859	158,902	24,141	714,089	2%
2020	868,886	435,480	386,735	55,512	1,746,613	6%
2025	1,077,803	572,251	445,296	70,812	2,166,162	8%
2030	1,351,586	736,599	554,314	82,694	2,725,193	10%
2030 Savings Share of 2030 Reference Consumption	10%	8%	11%	11%	10%	
2030 Savings share by Region	50%	27%	20%	3%	100%	

Exhibit 35 Aggressive Achievable Natural Gas Savings for the Total FortisBC Service Area by Industrial Sub sector and Milestone Year (GJ/yr.)

Sub sector	2015	2020	2025	2030	2030 Savings Share of Total 2030 Savings
Agriculture	88,585	194,872	244,772	311,333	11%
Chemical	69,353	212,909	265,068	334,858	12%
Fabricated Metal	45,010	80,935	96,173	116,077	4%
Food & Beverage	84,239	218,345	272,906	346,051	13%
Mining	60,165	153,812	191,874	242,899	9%
Miscellaneous Manufacturing	7,606	23,902	28,040	33,391	1%
Non-Metal Manufacturing	41,004	107,877	128,079	154,294	6%
Pulp and Paper	229,114	43,790	51,871	62,349	2%
Wood Products	67,370	522,266	652,615	826,135	30%
Other	21,643	187,904	234,765	297,805	11%
Total	714,089	1,746,613	2,166,162	2,725,193	100%

Note: Any difference in totals is due to rounding.

Exhibit 36 Aggressive Achievable Natural Gas Savings for the Total FortisBC Service Area by End Use and Milestone Year (GJ/yr.)

Technology	2015	2020	2025	2030	2030 Savings Share of 2030 Reference Consumption	2030 Savings Share of Total 2030 Savings
Boilers	390,822	998,569	1,202,543	1,508,764	11%	55%
Air Heating	110,709	218,743	324,178	427,137	14%	16%
Ovens	940	8,268	12,555	17,497	3%	1%
Heat Treating	3,619	32,879	46,145	59,507	11%	2%
Lumber Kilns	64,712	129,680	187,632	240,220	39%	9%
Veneer Dryers	9,785	19,271	28,357	36,955	2%	1%
Pulp Lime Kilns	7,211	20,293	39,441	63,846	16%	2%
Cement Kilns	2,558	23,427	33,149	42,988	5%	2%
Ore Drying	2,032	4,869	5,279	5,928	0%	0%
Coal Drying	53,356	127,832	110,862	124,497	24%	5%
Direct Fired	68,344	162,783	176,021	197,856	11%	7%
Total	714,089	1,746,613	2,166,162	2,725,193	10%	100%

Note: Any difference in totals is due to rounding.

Exhibit 37 Aggressive Marketing Achievable Natural Gas Savings for the Total FortisBC Service Area by Technology and Milestone Year (GJ/yr.)

End Use	Technology	2015	2020	2025	2030	2030 Savings Share of Total 2030 Savings	Average B/C Ratio
Coal and Ore Drying	High-efficiency Coal and Ore Dryers	55,388	132,701	116,140	130,425	5%	15 (Coal)
Cement Kilns	High-efficiency Kiln	2,558	23,427	33,149	42,988	2%	9.1
Pulp Lime Kiln	High-efficiency Kiln	7,211	20,293	39,441	63,846	2%	7.0
Direct Fired	Direct-fired Heating- Gypsum and Asphalt	68,344	162,783	176,021	197,856	7%	5.5
Ovens	High-efficiency Ovens	940	8,268	12,555	17,497	1%	5.4
Heat Treating	Heat Treating Furnace with Sequential Firing, High-velocity Burners	3,619	32,879	46,145	59,507	2%	5.4
Veneer Dryers	Advanced Veneer Dryer	9,785	19,271	28,357	36,955	1%	5.4
Air Heating	Radiant Tube Heating	110,709	218,743	324,178	427,137	16%	4.4
Lumber Kiln	High-efficiency Kiln	64,712	129,680	187,632	240,220	9%	4.2
Boilers	Efficient Boilers	373,963	950,508	1,110,661	1,367,177	50%	~4
Process Water Heating	Direct-fired Water Heating	7,988	24,561	50,261	81,010	3%	
Paper Drying	Direct-fired Paper Drying	8,871	23,500	41,621	60,576	2%	
	Total	714,089	1,746,613	2,166,162	2,725,193	100%	

Note: Any difference in totals is due to rounding.

7.4.2 *Natural Gas Consumption Savings – Most Likely Achievable Scenario*

The following exhibits present the potential natural gas savings under the most likely Achievable Potential scenario. The results shown are relative to the Reference Case. The results are broken down as follows:

- Exhibit 38 presents the results for the total FortisBC service territory by service region and milestone year.
- Exhibit 39 presents the results for the total FortisBC service territory by sub sector and milestone year.
- Exhibit 40 presents the results for the total FortisBC service territory by end use and milestone year.
- Exhibit 41 presents the results for the total FortisBC service territory by technology and milestone year.

Exhibit 38 Most Likely Achievable Natural Gas Savings by Service Region and Milestone Year (GJ/yr.)

Year	Lower Mainland	Northern Interior	Southern Interior	Vancouver Island	Grand Total	Savings Share of 2030 Reference Consumption
2015	236,686	121,019	125,568	16,317	499,589	2%
2020	499,166	253,895	278,172	33,695	1,064,929	4%
2025	727,212	385,275	343,947	48,817	1,505,251	5%
2030	975,680	525,685	447,794	60,828	2,009,988	7%
2030 Savings Share of 2030 Reference Consumption	7%	6%	9%	8%	7%	
2030 Savings share by Region	49%	26%	22%	3%	100%	

The energy saving percent calculations in Exhibit 38 are calculated on the Reference Case forecast. For example, the grand total savings of 7% in 2030 is 2,009,988 divided by the Reference Case forecast consumption of 27,946,000.

Exhibit 39 Most Likely Achievable Natural Gas Savings for the Total FortisBC Service Area by Industrial Sub sector and Milestone Year (GJ/yr.)

Sub sector	2015	2020	2025	2030	2030 Savings Share of Total 2030 Savings
Agriculture	61,976	118,816	170,090	229,626	11%
Chemical	48,521	129,813	184,194	246,977	12%
Fabricated Metal	31,489	49,347	66,830	85,613	4%
Food & Beverage	58,935	133,127	189,640	255,233	13%
Mining	42,093	93,781	133,332	179,152	9%
Miscellaneous Manufacturing	5,322	14,574	19,485	24,628	1%
Non-Metal Manufacturing	28,687	65,774	89,001	113,801	6%
Pulp and Paper	160,292	26,699	36,045	45,986	2%
Wood Products	47,133	318,431	453,497	609,323	30%
Other	15,142	114,567	163,137	219,648	11%
Total	**499,589**	**1,064,929**	**1,505,251**	**2,009,988**	100%

Note: Any difference in totals is due to rounding.

Exhibit 40 Most Likely Achievable Natural Gas Savings for the Total FortisBC Service Area by End Use and Milestone Year (GJ/yr.)

Technology	2015	2020	2025	2030	2030 Savings Share of 2030 Reference Consumption	2030 Savings Share of Total 2030 Savings
Boilers	256,269	527,267	823,065	1,153,094	9%	57%
Air Heating	88,567	174,994	259,343	341,709	11%	17%
Ovens	470	4,134	6,278	8,748	1%	0%
Heat Treating	1,809	16,439	23,073	29,753	6%	1%
Lumber Kilns	48,534	97,260	140,724	180,165	29%	9%
Veneer Dryers	6,116	12,044	17,723	23,097	1%	1%
Pulp Lime Kilns	2,884	8,117	15,777	25,538	6%	1%
Cement Kilns	6,395	13,015	17,758	21,494	3%	1%
Ore Drying	1,016	2,435	2,639	2,964	0%	0%
Coal Drying	53,356	127,832	110,862	124,497	24%	6%
Direct Fired	34,172	81,391	88,010	98,928	6%	5%
Total	499,589	1,064,929	1,505,251	2,009,988	7.2%	100%

Note: Any difference in totals is due to rounding.

Exhibit 41 Most Likely Achievable Natural Gas Savings for the Total FortisBC Service Area by Technology and Milestone Year (GJ/yr.)

End Use	Technology	2015	2020	2025	2030	2030 Savings Share of Total 2030 Savings	Average B/C Ratio
Boilers	Efficient Boilers	246,382	499,132	769,372	1,070,457	53%	~4
Air Heating	Radiant Tube Heating	88,567	174,994	259,343	341,709	17%	4.4
Process Water Heating	Direct-fired Water Heating	4,564	14,035	28,720	46,292	2%	
Ovens	High-efficiency Ovens	470	4,134	6,278	8,748	0%	5.4
Heat Treating	Heat Treating Furnace with Sequential Firing, High-velocity Burners	1,809	16,439	23,073	29,753	1%	5.4
Lumber Kiln	High-efficiency Kiln	48,534	97,260	140,724	180,165	9%	4.2
Veneer Dryers	Advanced Veneer Dryer	6,116	12,044	17,723	23,097	1%	5.4
Paper Drying	Direct-fired Paper Drying	5,323	14,100	24,973	36,346	2%	
Pulp Lime Kiln	High-efficiency Kiln	2,884	8,117	15,777	25,538	1%	7.0
Cement Kilns	High-efficiency Kiln	6,395	13,015	17,758	21,494	1%	9.1
Coal and Ore Drying	High-efficiency Coal and Ore Dryers	54,372	130,266	113,501	127,461	6%	15 (Coal)
Direct Fired	Direct-fired Heating- Gypsum and	34,172	81,391	88,010	98,928	5%	5.5
	Total	499,589	1,064,929	1,505,251	2,009,988	100%	

Note: Any difference in totals is due to rounding.

7.4.3 *Peak Day Load Impacts – Energy-efficiency Scenarios*

This sub section estimates the peak day load impact that would occur as a result of the Achievable Potential scenarios presented in the preceding exhibits. Peak day load impact measures the relationship between a typical or average daily consumption rate and the consumption that occurs on a peak day when the demand for natural gas is at a maximum. The relationship is illustrated in the formula below.

$$\textit{Peak Day Consumption} = \frac{\textit{Average Daily Consumption}}{\textit{Load Factor}}$$

The following steps were employed to derive the estimated peak day load impacts:

- Annual natural gas decreases associated with each of the preceding Achievable Potential scenarios were identified (GJ/yr.).

FortisBC provided load factors that correlate the relationship between average and peak day consumption levels for each rate class and service region.

Finally, peak day load impacts were calculated by dividing the average daily consumption by the appropriate sector and service region load factors. The results for the aggressive Achievable Potential are presented in

- Exhibit 43 and the results for the most likely Achievable Potential are presented in Exhibit 44.

Exhibit 42 Peak Day Load Factors, by Sector and Service Region

CPR Sector	Sales Weighted Average/Peak Load Factor, by Sector & Service Region*		
	Lower Mainland	Vancouver Island	Interior
Residential	0.316	0.382	0.304
Commercial & Institutional	0.34	0.491	0.36
Industrial	0.369	0.509	0.443

*Above sector load factors are sales weighted values based on the rate class load factors shown below.

Rate Class	Average/Peak Load Factor, by Rate Class & Service Region#		
	Lower Mainland	Vancouver Island	Interior
1	*0.308*	*0.354*	*0.304*
2	*0.293*	*0.473*	*0.296*
3	*0.366*	*0.509*	*0.347*
5	*0.433*	*0.51*	*0.511*

#Source: FortisBC

Exhibit 43 and Exhibit 44 summarize the estimated peak day load impacts for each of the Achievable Potential scenarios. As illustrated, the natural gas savings contained in the two Achievable Potential scenarios would result in a total peak day load reduction of approximately 17,000 to 23,000 GJ by 2030, depending on scenario.

Exhibit 43 Peak Day Capacity Impacts – Aggressive Achievable Potential, by Scenario, Service Region and Milestone Year (GJ)

Year	Lower Mainland	Northern Interior	Southern Interior	Vancouver Island	Grand Total
2015	3,250	1,398	1,228	162	6,039
2020	8,064	3,367	2,990	373	14,794
2025	10,003	4,424	3,442	476	18,346
2030	12,544	5,694	4,285	556	23,080

Exhibit 44 Peak Day Capacity Impacts – Most Likely Achievable Potential, by Scenario, Service Region and Milestone Year (GJ)

Year	Lower Mainland	Northern Interior	Southern Interior	Vancouver Island	Grand Total
2015	2,197	936	971	110	4,213
2020	4,633	1,963	2,150	227	8,973
2025	6,749	2,978	2,659	328	12,715
2030	9,055	4,064	3,462	409	16,990

7.4.4 *Greenhouse Gas Emission Impact – Energy-efficiency Scenarios*

The natural gas savings associated with each of the Achievable Potential scenarios would also result in a reduction of greenhouse gas (GHG) emissions.[20] As illustrated in Exhibit 45 and Exhibit 46, by 2030 the GHG reductions are estimated to be in the range of 96,000 to 130,000 tonnes/yr., depending on the scenario.

Exhibit 45 Estimated GHG Emission Reductions – Aggressive Achievable Potential, By Scenario and Milestone Year (tonnes CO_2e/yr.)

Year	Lower Mainland	Northern Interior	Southern Interior	Vancouver Island	Grand Total
2015	16,809	8,681	7,627	1,159	34,276
2020	41,707	20,903	18,563	2,665	83,837
2025	51,735	27,468	21,374	3,399	103,976
2030	64,876	35,357	26,607	3,969	130,809

Exhibit 46 Estimated GHG Emission Reductions – Most Likely Achievable Potential, By Scenario and Milestone Year (tonnes CO_2e/yr.)

Year	Lower Mainland	Northern Interior	Southern Interior	Vancouver Island	Grand Total
2015	11,361	5,809	6,027	783	23,980
2020	23,960	12,187	13,352	1,617	51,117
2025	34,906	18,493	16,509	2,343	72,252
2030	46,833	25,233	21,494	2,920	96,479

7.4.5 *Interpretation of Results*

Highlights of the potential natural gas savings presented in the preceding exhibits are summarized below:

[20] GHG impacts are estimated based on an emissions factor of 48 kg of CO_2e per GJ of natural gas. This is the B.C. natural gas emissions factor.

Savings by Service Region

The Lower Mainland service region represents approximately 50% of the identified savings in either of the two Achievable Potential scenarios. This is consistent with the large number of Industrial sector customers in this service region. The Northern Interior region represents approximately 25% of the identified savings, followed by Southern Interior at 22% and Vancouver Island at 3%.

Large industry is concentrated in the Lower Mainland and Northern Interior. The Vancouver Island Gas Joint Venture natural gas consumers' plants located on Vancouver Island were not included in the full CPR study. However, given their annual load (2010) of approximately 3,000,000 GJ, it could be assumed that if these customers were to participate in FortisBC's pulp and paper program, Achievable savings would increase about 10% respectively.

The Achievable Potential savings share of the Reference Case consumption in 2030 is fairly even across the regions, with the Southern Interior slighter higher than the other regions. The reason for this is due to the penetration rate of the lumber industry projects in the region, along with the identified coal facility for high-efficiency coal dryer project(s).

In the Southern Interior region, potential savings are 9%-11% of the Reference Case consumption in 2030, respective of the most likely or aggressive levels of Achievable Potential. This is the highest percentage of any of the regions. In the Lower Mainland region, potential savings are 7%-10% of the Reference Case consumption in 2030. In the Northern Interior, potential savings are 6%-8% of Reference Case consumption in 2030. In the Vancouver Island region, they are 8%-11% of Reference Case consumption in 2030.

Savings by Industrial Sub Sector

The Pulp and Paper sub sector accounts for almost 30% of potential energy savings by 2030. Improvement to lime kiln efficiency, boiler upgrades/replacements, process heat conservation, heat recovery projects, and moving to direct-fired paper drying are the savings measures available to this sub sector. The Agriculture and Food & Beverage sub sectors together account for about 25% of the 2030 total Achievable Potential savings. Boiler upgrades and heat recovery projects are responsible for the majority of the savings in these sub sectors. The Chemical sub sector could provide up 12% of potential savings, while the forecast portion of 2030 savings for the Wood Products and Mining sub sectors are 11% and 9% respectively. The remaining 12% of the potential savings in 2030 comprise the Fabricated Metal, Non-Metal Manufacturing, Miscellaneous Manufacturing and Other sub sectors.

Savings by End Use

Boiler replacement, upgrades, heat recovery, process heat conservation and controls, represent almost 55% of the total energy savings in the two Achievable Potential scenarios. Since these technologies are here today, the model for the economic savings assumed that all upgrades would occur during the first milestone period. The reason for this assumption is that the economic analysis indicates that the return on investment of replacing standard equipment is such that replacing all standard equipment could be justified over that period. The largest volume of savings was provided by replacing standard efficiency boilers with higher efficiency units. The Achievable case was more conservative, and assumed that the boilers would be replaced over time, typically prompted by the need replacement or major rework.

Radiant tube air heating technology offers significant savings over the standard natural gas space heating equipment in large high-bay type buildings typical in the Industrial sector because the air itself does not need to be heated, only energy radiated down to the working space. These types of heaters are particularly useful near large doors / shipping bays, which are frequently open. The saving potential for radiant heaters is large at 14%-17% of the total Achievable Potential savings. From a conservation potential, this is the second largest individual technology, due to the large number of high-bay buildings across the Industrial sector.

Lumber drying kilns show considerable potential for energy savings. The recent economy and wood market have historically been barriers to improving the efficiency or replacing kilns. Accordingly, there is a large inventory of older inefficient kilns that are in operation and there is a significant potential to either retrofit or replace them.

Savings potential for direct-fired drying and heating of gypsum and asphalt plants is about 5% by 2030. Coal dryers are limited in numbers, however one or two projects could provide upwards of 5% of the 2030 Achievable savings. These projects would be in the Southern Interior.

Peak Day Capacity Impacts

The natural gas savings contained in the two Achievable Potential scenarios would result in a total peak day load reduction of approximately 17,000 to 23,000 GJ by 2030, depending on the scenario.

Greenhouse Gas Emission Impacts

By 2030 the GHG reductions are estimated to be in the range of 96,000 to 130,000 tonnes per year, depending on scenario.

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9 Glossary

achievable potential
The Achievable Potential is the proportion of the natural gas savings identified in the Economic Potential Forecast that could realistically be achieved within the study period. Achievable Potential recognizes that it is difficult to induce customers to purchase and install all of the efficiency technologies that meet the criteria defined by the Economic Potential Forecast.

avoided cost
The unit cost of acquiring the next resource to meet demand, which is used as a measure for evaluating individual demand side and supply side options. In the context of this study "avoided cost" is the capital expenditure offset by FortisBC's DSM activities (i.e., the cost of having to buy natural gas on the open market, contract for long-term supply, and the cost of associated transmission and storage.

Avoided supply cost of electricity
The avoided supply cost of electricity is a value that is used to determine economic value of reducing or increasing the amount of electricity used by a technology. The value of avoided cost of electricity used in this report was proved by BC Hydro and was $0.12 per kWh.

Avoided cost of natural gas
The avoided supply cost of natural gas is a value that is used to determine the economic value of reducing or increasing the amount of electricity used by a technology. The value of avoided cost of natural used in this report was provided by FortisBC and varies according to the life of the measure of technology. Specific values are provided in Exhibit 22.

base year
The Base Year is the year to which all potentials will be compared. It provides a detailed description of "where" and "how" natural gas is currently used in each sector. For this study, it is the calendar year 2010. The modeled base year energy use is calibrated against FortisBC's actual sales for 2009.

benefit-cost ratio
The measure benefit-cost ratio indicates the relative attractiveness of the measures. A measure that has a benefit-cost ratio in excess of 1.0 has benefits that outweigh its costs. Similarly, a measure with a benefit-cost ratio that is well in excess of one (e.g., 3.0) means that it is very attractive. A measure with a benefit-cost ratio of less than 1.0 has costs that outweigh its benefits.

building envelope
The material separation between the interior and exterior environments of a building. The building envelope serves as the outer shell to protect the indoor environment as well as to facilitate its climate control.

British thermal unit or Btu
The standard measure of heat energy. It takes one Btu to raise the temperature of one pound of water by one degree Fahrenheit at sea level.

cogeneration
The simultaneous production of electric or mechanical energy and useful heat energy from a single fuel source.

combustion efficiency
The ratio of energy released during combustion to the potential chemical energy available in the fuel.

demand side management (DSM)
Actions taken by a utility or other agency that are expected to influence the amount or timing of a customer's energy consumption.

discount rate
The interest rate used in calculating the present value of expected yearly benefits and costs.

economic efficiency
Allocation of human and natural resources in a way that results in the greatest net economic benefit, regardless of how benefits and costs are distributed within society.

economic potential forecast
The Economic Potential Forecast is an estimate of the level of natural gas consumption that would occur if all equipment and building envelopes were upgraded to the level that is cost effective from society's perspective. All of the energy-efficiency technologies and measures that have a positive measure TRC are incorporated into the Economic Potential Forecast. These technologies and measures are applied at either natural stock turnover rates or at designated years for immediate application.

energy audit
An on-site inspection and cataloguing of energy using equipment/buildings, energy consumption and related end uses. The purpose is to provide information to the customer and the utility. Audits are useful for load research, for DSM program design and for identification of specific energy savings measures.

energy conservation
Activities by energy users that result in a reduction of the energy used to provide services. Energy conservation can include a wide variety of behavioural or operational changes that result in energy savings.

energy efficiency
Using less energy to perform the same function.

energy intensity
The ratio of energy consumed per application or end use. For example, cubic metres per square metre of heated office space per day, or cubic metres per tonne of aluminum produced. All else being equal, energy intensity increases as energy efficiency decreases.

emerging technologies
New energy-conserving technologies that are not yet market ready, but may be market ready over next five to 10 years. This category includes technologies that could be accelerated into the market during that period through targeted financial or technical support.

end use
The final application or final use to which energy is applied. End use is often used interchangeably with energy service.

energy savings
The reduction in use of energy from the pre-retrofit baseline to the post-retrofit energy use that result from efficient technologies or activities. In this document, the term “energy” refers specifically to energy derived from natural gas unless otherwise noted.

energy service
An amenity or service supplied jointly by energy and other components/equipment such as buildings and heating equipment. Examples of energy services include residential space heating, commercial cooking, aluminum smelting and public transit. The same energy service can frequently be supplied with different mixes of equipment and energy.

energy use index (EUI)
End-use energy consumption divided by a specific parameter of production (e.g., m^3/unit).

environmental credit/environmental penalty
An increment or decrement to the cost of a resource or set of resources, to reflect the overall level of its/their environmental impact, relative to another resource or set of resources.

financial incentive
Certain financial features in the utility’s DSM programs designed to motivate customer participation. They may include features designed to reduce a customer’s net cash outlay, payback period or cost of finance to participate.

fuel share
The proportion of requirements for a specific service that is met using a certain fuel. In the Commercial sector, fuel shares are normalized on a floor area basis. For example, a natural gas fuel share of 90% for space heating in the Large Office sub sector implies that 90% of the sub sector floor space is heated using natural gas.

full capital cost
This is the capital cost of replacing a baseline technology with an energy-efficient technology and is applicable before equipment end of life. For example if a standard boiler is in good operating condition and has many years of life left, the full cost of replacement would apply.

free rider
A program participant who would have implemented the program measure or practice in the absence of the program.

Incremental capital cost
This is the capital cost difference between a baseline technology and an energy-efficient technology and is applicable at equipment end of life. For example, if a standard boiler had reached its end of life the incremental capital cost would be the cost difference between replacing the boiler with a standard boiler and a more efficient boiler.

interactive effects
In the context of natural gas use, interactive effects refer to the increase in gas consumed by heating equipment required to offset a decrease in “waste” heat generated by more efficient electrical fixtures or appliances after retrofit or replacement.

kilowatt (kW)
One thousand watts; the most common unit of measurement of electric power. (The amount of energy transferred at a rate of one kilowatt for one hour is equal to one kilowatt hour.)

kilowatt hour (kWh)
The most common unit of measurement of electric energy. One kilowatt hour represents the power of one thousand watts for a period of one hour.

load forecast
An estimate of expected natural gas requirements that have to be met by the utility in future years.

load research
Research to disaggregate and analyze patterns of natural gas consumption by various sub sectors and end uses. Load research supports the development of the load forecast and the design of DSM programs.

market transformation
A reduction in market barriers resulting from a market intervention, as evident by a set of market effects that lasts after the intervention has been withdrawn, reduced or changed.

measure total resource cost (TRC)
The measure TRC is the net present value of energy savings that result from an investment in an energy-efficiency measure. The measure TRC is equal to its full or incremental capital cost (depending on application) plus any change (positive or negative) in the combined annual energy and operating and maintenance (O&M) costs. This calculation includes among others, the following inputs: the avoided natural gas, electricity and water, the life of the measure, and the selected discount rate.

natural conservation
The future change in energy intensity or base usage that is expected to occur in the absence of utility DSM programs. Natural change represents the effects of energy related decisions that would have been made in the absence of the utility programs by both program participants and non-participants.

rate
Generically refers to a utility's rate structure.

rate structure
The formulae used by a regulated gas utility to calculate charges for the use of natural gas.

rebates
A type of incentive provided to encourage the adoption of energy-efficient practices, typically paid after the measure has been installed. There are typically two types of rebates: 1) a prescriptive rebate, which is a prescribed financial incentive/unit for a prescribed list of products, and 2) a customized rebate in which the financial incentive is determined using an analysis of the customer equipment and an agreement on the specific products to be installed.

reference case forecast
An estimate of the expected level of natural gas consumption that would occur over the study period in the absence of any new utility DSM market interventions after 2010. It is the baseline against which the scenarios of energy savings are calculated. The Reference Case forecast incorporates an estimation of "natural" conservation, namely, changes in end-use efficiency over

the study period that are projected to occur in the absence of new market interventions by the utility.

retrofit
Energy-efficiency activities undertaken in existing residential or non-residential buildings where existing inefficient equipment is replaced by efficient equipment.

saturation
The portion of floor area that receives a specific energy service. For example, a saturation of 86% for space cooling in the Large Office sub sector means that 86% of the sub sector floor space is cooled (regardless of fuel used to provide that cooling).

seasonal efficiency
The ratio of delivered useful energy relative to the input potential fuel energy determined over a full heating season (or year).

sector
A group of customers having a common type of economic activity.

service area
The portion of the Province of British Columbia that receives service from FortisBC Gas.

service region
For the purposes of this study, the total FortisBC Gas service area is divided into two service regions. They are the Southern region and the Eastern region.

simple payback
The simple payback is generated to show the customer's financial perspective. Simple payback is a measure of the length of time required for the cumulative savings from a project to recover its initial investment cost, without taking into account the time value of money.

sub sectors
A classification of customers within a sector by common features. Residential sub sectors are by type of home (single-family detached, duplex, apartment, etc.). Commercial sub sectors are generally by type of commercial service (Office, Retail, Warehouse, etc.). Industrial sub sectors are by product type (Pulp and Paper, Wood Products, Chemical, etc.).

supply curves
A curve illustrating the amount of energy (e.g., m^3) or societal benefit available at an appropriate screened price in ascending order of cost.

total resource cost (TRC) Test
A test that compares the total costs of energy-efficiency investments, including natural gas conservation programs, to the social cost of natural gas. Unpriced environmental and social costs may be accounted for by changing the cost of either the investment under consideration or the total cost of natural gas in such a way that relative unpriced impacts are reflected. It is used in designing and evaluating programs that are developed from the energy-efficiency potential study's results.

utility cost
The total financial cost incurred by the utility to acquire energy resources. For DSM, the costs include all utility program costs, including incentive costs.

watt
The basic unit of measurement of power, at a point in time as capacity or demand.

CONSERVATION POTENTIAL REVIEW FORTISBC

Industrial Sector

Energy-efficiency & Alternative Energy Opportunities

Appendices

Submitted to
FortisBC

Submitted by
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List of Appendices

Appendix A Background-Chapter 3: Base Year Natural Gas Use

Region/Rate Schedule		2009 FortisBC	Milestong Industrial Forecast (GJ)					
FEVI		**Total (GJ)**	**Rate Schedule**	**2010**	**2015**	**2020**	**2025**	**2030**
2		89,672	Included below in Non-interruptible					
3		352,205	Included below in Non-interruptible					
ILF		201,394	ILF					
HLF		540,072	HLF					
FEVI	Industrial Total	**1,183,343**	**ILF & HLF Total**	**909,908**	**758,336**	**744,748**	**731,826**	**719,537**
Lower Mainland		**Total (GJ)**						
2		2,274,504						
3		1,828,129						
23		1,220,101						
5		221,120						
7		2,879						
22		9,611,266						
25		4,811,233						
27		3,560,082						
Subtotal	***2,3,5,23,25***	***10,355,087***	**2,3,5,23,25**	7,552,746	5,886,274	5,863,709	5,842,249	5,821,842
Subtotal	***7,22,27***	***13,174,226***	**7,22,27**	9,722,569	7,880,524	7,725,930	7,578,913	7,439,101
Lower Mainland	Industrial Total	**23,529,314**	**Total**	**17,275,315**	**13,766,798**	**13,589,638**	**13,421,162**	**13,260,942**
Northern Interior		**Total (GJ)**						
2		412,809						
3		273,308						
23		143,520						
5		76,182						
7		3,832						
22		10,793,252						
25		1,737,485						
27		442,184						
Subtotal	***2,3,5,23,25***	***2,643,303***	**2,3,5,23,25**	1,692,627	1,462,453	1,452,835	1,443,688	1,434,990
Subtotal	***7,22,27***	***11,239,268***	**7,22,27**	10,173,191	7,479,550	7,466,661	7,454,403	7,442,746
Northern Interior	Industrial Total	**13,882,571**	**Total**	**11,865,818**	**8,942,003**	**8,919,496**	**8,898,091**	**8,877,736**
Southern Interior		**Total (GJ)**						
2		416,484						
3		242,657						
23		149,542						
5		20,900						
7		-						
22		5,371,814						
25		1,311,473						
27		246,097						
Total Without Special		**7,758,967**						
Subtotal	***2,3,5,23,25***	***2,141,056***	**2,3,5,23,25**	1,509,716	1,282,526	1,268,677	1,255,507	1,242,982
Subtotal	***7,22,27***	***5,617,911***	**7,22,27**	4,895,399	3,844,599	3,844,599	3,844,599	3,844,599
Southern Interior	Industrial Total	**7,758,967**	**Total**	**6,405,115**	**5,127,126**	**5,113,276**	**5,100,106**	**5,087,581**
All Service Areas		**Total (GJ)**						
2		3,193,469						
3		2,696,299						
23		1,513,163						
5		318,202						
7		6,711						
22		25,776,332						
25		7,860,191						
27		4,248,363						
ILF		201,394						
HLF		540,072						
Van Island		***1,183,343***	**ILF. HLF**	909,908	758,336	744,748	731,826	719,537
Subtotal	***2,3,5,23,25***	***15,139,446***	**2,3,5,23,25**	10,755,089	8,631,254	8,585,221	8,541,444	8,499,813
Subtotal	***7,22,27***	***30,031,405***	**7,22,27**	24,791,159	19,204,673	19,037,190	18,877,915	18,726,446
All Service Areas Industrial without Burrard & Special		**46,354,195**	**Total**	**36,456,156**	**28,594,262**	**28,367,158**	**28,151,185**	**27,945,797**

Reference Case 2010 Base Year Consumption and Useful Heat by Sub Sector
ALL SERVICE AREAS

Agriculture		Annual Sales		Annual Useful Heat	
		Market Share	Total Sales	Conversion & Process Efficiency	Total Useful Heat
END USE		(%)	(GJ)	(%)	(GJ)
Air Heating	Standard Efficiency Air Handling Units and Unit Heaters	14%	633,268	55%	348,804
	High-efficiency Air Handling Units and Unit heaters (Condensing)	4%	180,934	68%	123,107
	Radiant Tube Heating	2%	90,467	56%	51,064
Boilers - Process	Standard Efficiency Boiler	15%	686,110	55%	377,993
	Near Condensing Boiler	6%	289,429	74%	213,985
	Condensing Boiler	57%	2,569,961	90%	2,320,888
Water Heaters	Tank-type Water Heating	2%	72,357	42%	30,314
Total		**100%**	**4,522,525**		**3,466,156**

Reference Case 2010 Base Year Consumption and Useful Heat by Sub Sector
ALL SERVICE AREAS

Chemical		Annual Sales		Annual Useful Heat	
		Market Share	Total Sales	Conversion & Process Efficiency	Total Useful Heat
END USE		(%)	(GJ)	(%)	(GJ)
Air Heating	Standard Efficiency Air Handling Units and Unit Heaters	4%	153,781	52%	79,988
	Radiant Tube Heating	2%	76,567	61%	46,503
Boilers - Process	Standard Efficiency Boiler	14%	483,488	58%	278,101
	Near Condensing Boiler	18%	620,107	71%	440,134
	Condensing Boiler	3%	109,606	75%	82,718
Direct Fired	Direct-Fired Heating	31%	1,104,865	54%	596,627
Direct Consumptic	Gas Consumed in Process	28%	992,252	100%	992,252
Total		**100%**	**3,540,666**		**2,516,323**

Reference Case 2010 Base Year Consumption and Useful Heat by Sub Sector
ALL SERVICE AREAS

Fabricated Metal		Annual Sales		Annual Useful Heat	
		Market Share	Total Sales	Conversion & Process Efficiency	Total Useful Heat
END USE		(%)	(GJ)	(%)	(GJ)
Air Heating	Standard Efficiency Air Handling Units and Unit Heaters	15%	341,195	51%	173,491
	High-efficiency Air Handling Units and Unit heaters (Condensing)	3%	69,202	63%	43,919
	Radiant Tube Heating	12%	281,626	57%	159,383
Boilers - Process	Standard Efficiency Boiler	4%	86,311	54%	46,593
	Near Condensing Boiler	3%	64,733	72%	46,293
Heat Treating	Standard Efficiency Heat Treating	33%	753,742	40%	301,497
	Heat Treating Furnace with	19%	447,434	53%	237,140
Direct Fired	Direct-Fired Heating	11%	253,613	54%	136,951
Total		**100%**	**2,297,858**		**1,145,267**

Reference Case 2010 Base Year Consumption and Useful Heat by Sub Sector
ALL SERVICE AREAS

Food & Beverage		Annual Sales		Annual Useful Heat	
		Market Share	Total Sales	Conversion & Process Efficiency	Total Useful Heat
END USE		(%)	(GJ)	(%)	(GJ)
Boilers	Standard Efficiency Boiler	2%	103,911	51%	53,177
	Near Condensing Boilers	0.4%	15,218	59%	8,927
	Condensing Boiler	0.3%	12,273	67%	8,218
Air Heating	Standard Efficiency Air Handling Units and Unit Heaters	6%	237,246	52%	123,554
	High-efficiency Air Handling Units and Unit heaters (Condensing)	1%	21,532	65%	13,937
	Radiant Tube Heating	1%	40,459	58%	23,392
Boilers - Process	Standard Efficiency Boiler	50%	2,168,635	50%	1,080,545
	Near Condensing Boiler	11%	490,839	58%	282,320
	Condensing Boiler	8%	356,743	65%	232,364
Water Heaters	Tank-type Water Heating	3%	119,499	45%	54,025
	Instantaneous Water Heater	1%	47,800	61%	29,024
Ovens	Standard Efficiency Oven	6%	255,117	70%	177,817
	Efficient Oven	5%	231,971	82%	191,026
Direct Fired	Direct-Fired Heating	5%	199,366	54%	107,658
Total		**100%**	**4,300,611**		**2,385,984**

Reference Case 2010 Base Year Consumption and Useful Heat by Sub Sector

ALL SERVICE AREAS

Mining		Annual Sales		Annual Useful Heat	
		Market Share	Total Sales	Conversion & Process Efficiency	Total Useful Heat
END USE		(%)	(GJ)	(%)	(GJ)
Boilers	Standard Efficiency Boiler	2%	58,897	57%	33,290
	Near Condensing Boilers	2%	48,334	65%	31,296
	Condensing Boiler	1%	44,814	73%	32,854
Air Heating	Standard Efficiency Air Handling Units and Unit Heaters	1%	28,594	55%	15,748
	High-efficiency Air Handling Units and Unit heaters (Condensing)	0%	10,562	68%	7,215
	Radiant Tube Heating	1%	28,594	61%	17,341
Boilers - Process	Standard Efficiency Boiler	13%	397,348	51%	203,943
	Near Condensing Boiler	12%	368,966	59%	216,467
	Condensing Boiler	9%	283,820	66%	185,950
Ore Drying	Standard Efficiency Ore Dryer	5%	145,710	63%	91,069
Coal Drying	Standard Efficiency Coal Dryer	53%	1,642,354	63%	1,026,471
Direct Fired	Direct-Fired Heating	0%	13,610	54%	7,349
Total		**100%**	**3,071,601**		**1,868,994**

Reference Case 2010 Base Year Consumption and Useful Heat by Sub Sector

ALL SERVICE AREAS

Miscellaneous Manufacturing		Annual Sales		Annual Useful Heat	
		Market Share	Total Sales	Conversion & Process Efficiency	Total Useful Heat
END USE		(%)	(GJ)	(%)	(GJ)
Boilers	Standard Efficiency Boiler	2%	6,159	53%	3,279
	Near Condensing Boilers	1%	3,080	61%	1,871
	Condensing Boiler	0%	1,232	69%	846
Air Heating	Standard Efficiency Air Handling Units and Unit Heaters	8%	30,797	52%	16,140
	High-efficiency Air Handling Units and Unit heaters (Condensing)	2%	8,007	65%	5,238
	Radiant Tube Heating	73%	283,867	56%	159,224
Boilers - Process	Standard Efficiency Boiler	2%	8,277	51%	4,205
	Near Condensing Boiler	1%	2,759	58%	1,599
Water Heaters	Tank-type Water Heating	1%	5,518	45%	2,495
	Instantaneous Water Heater	1%	5,518	61%	3,351
Ovens	Standard Efficiency Oven	1%	5,518	70%	3,874
	Efficient Oven	1%	5,518	83%	4,553
Heat Treating	Standard Efficiency Heat Treating Furnace	1%	5,518	34%	1,876
	Heat Treating Furnace with Sequential Firing, High Velocity Burners	1%	5,518	53%	2,925
Miscellaneous	Miscellaneous Standard Equipment	1%	5,518	68%	3,741
	Miscellaneous Efficient Equipment	1%	5,518	82%	4,508
Total		**100%**	**388,324**		**219,725**

Reference Case 2010 Base Year Consumption and Useful Heat by Sub Sector
ALL SERVICE AREAS

Non-Metal Manufacturing		Annual Sales		Annual Useful Heat	
		Market Share	Total Sales	Conversion & Process Efficiency	Total Useful Heat
END USE		(%)	(GJ)	(%)	(GJ)
Air Heating	Standard Efficiency Air Handling Units and Unit Heaters	15%	322,615	51%	164,054
	High-efficiency Air Handling Units and Unit heaters (Condensing)	2%	46,088	63%	29,255
	Radiant Tube Heating	4%	92,176	57%	52,183
Boilers - Process	Standard Efficiency Boiler	2%	34,691	49%	17,098
	Near Condensing Boiler	1%	17,346	56%	9,755
Ovens	Standard Efficiency Oven	4%	93,842	73%	68,693
	Efficient Oven	1%	17,346	84%	14,588
Cement Kilns	Standard Efficiency Cement Kilns	31%	652,985	64%	418,563
	High-efficiency Cement Kilns	3%	69,383	82%	56,547
Direct Fired	Direct-Fired Heating	36%	746,869	54%	403,309
Total		**100%**	**2,093,340**		**1,234,045**

Reference Case 2010 Base Year Consumption and Useful Heat by Sub Sector
ALL SERVICE AREAS

Other		Annual Sales		Annual Useful Heat	
		Market Share	Total Sales	Conversion & Process Efficiency	Total Useful Heat
END USE		(%)	(GJ)	(%)	(GJ)
Air Heating	Standard Efficiency Air Handling Units and Unit Heaters	32%	351,693	52%	181,439
	High-efficiency Air Handling Units and Unit heaters (Condensing)	5%	50,242	64%	32,356
	Radiant Tube Heating	9%	100,484	57%	57,595
Boilers - Process	Standard Efficiency Boiler	16%	171,566	51%	87,150
	Near Condensing Boiler	7%	75,784	58%	43,926
	Condensing Boiler	5%	51,036	66%	33,437
Water Heaters	Tank-type Water Heating	5%	49,820	45%	22,524
	Instantaneous Water Heater	2%	24,301	61%	14,756
Laundry	Direct-Fired Gas Laundry Dryers	8%	85,718	50%	42,859
Direct Fired	Direct-Fired Heating	4%	47,073	54%	25,419
Direct Consumptic	Gas Consumed in Process	9%	97,204	100%	97,204
Total		**100%**	**1,104,921**		**638,665**

Reference Case 2010 Base Year Consumption and Useful Heat by Sub Sector

ALL SERVICE AREAS

Pulp and Paper		Annual Sales		Annual Useful Heat	
		Market Share	Total Sales	Conversion & Process Efficiency	Total Useful Heat
END USE		(%)	(GJ)	(%)	(GJ)
Boilers	Standard Efficiency Boiler	<.01%	39,505	67%	26,553
	Near Condensing Boilers	<.01%	15,932	73%	11,645
	Condensing Boiler	<.01%	26	64%	17
Air Heating	Standard Efficiency Air Handling Units and Unit Heaters	5%	529,543	56%	294,024
	High-efficiency Air Handling Units and Unit heaters (Condensing)	1%	155,541	69%	107,820
	Radiant Tube Heating	<.01%	39,113	61%	23,879
Boilers - Process	Standard Efficiency Boiler	34%	3,969,284	65%	2,567,139
	Near Condensing Boiler	14%	1,637,585	71%	1,165,505
Paper	Direct-Fired Paper Drying	10%	1,112,902	88%	974,902
Pulp Lime Kilns	Standard Efficiency Pulp Lime Kilns	27%	3,148,096	75%	2,361,072
	High-efficiency Pulp Lime Kilns	9%	1,049,365	91%	954,922
Total		**99%**	**11,696,893**		**8,487,479**

Reference Case 2010 Base Year Consumption and Useful Heat by Sub Sector

ALL SERVICE AREAS

Wood Products		Annual Sales		Annual Useful Heat	
		Market Share	Total Sales	Conversion & Process Efficiency	Total Useful Heat
END USE		(%)	(GJ)	(%)	(GJ)
Air Heating	Standard Efficiency Air Handling Units and Unit Heaters	3%	98,458	53%	51,960
	High-efficiency Air Handling Units and Unit heaters (Condensing)	<.01%	14,065	66%	9,266
	Radiant Tube Heating	<.01%	28,131	58%	16,442
Boilers - Process	Standard Efficiency Boiler	7%	230,913	51%	117,296
	Near Condensing Boiler	3%	98,963	58%	57,361
	Condensing Boiler	<.01%	32,988	66%	21,612
Direct-Fired	Direct-Fired Water Heating	5%	164,938	63%	103,416
Lumber Kiln	Standard Efficiency Kiln	60%	2,078,221	62%	1,290,575
	High-efficiency Kiln	8%	263,901	89%	233,552
Veneer Dryers	Standard Efficiency Veneer Dryer	10%	329,876	52%	171,866
	Advanced Veneer Dryer	3%	98,963	71%	70,264
Total		**100%**	**3,439,418**		**2,143,611**

Appendix B Background-Chapter 4: Reference Case Natural Gas Forecast

Base Year - Output for 2010

Total Industrial Sector			Lower Mainland		Northern Interior		Southern Interior		Vancouver Island		Total	
	#	Natural Gas Energy Conversion Device	Gas Sales (GJ)	Useful Heat (GJ)	Gas Sales (GJ)	Useful Heat (GJ)	Gas Sales (GJ)	Useful Heat (GJ)	Gas Sales (GJ)	Useful Heat (GJ)	Gas Sales (GJ)	Useful Heat (GJ)
Comfort Heat			**2,760,078**	**1,622,103**	**1,069,624**	**668,092**	**677,304**	**420,093**	**187,223**	**103,438**	**4,694,228**	**2,813,726**
Boilers	1	Standard Efficiency Boiler	93,021	47,123	44,612	28,393	68,858	39,780	1,981	1,003	208,472	116,299
	2	Near Condensing Boilers	16,106	9,477	18,121	12,727	47,903	31,285	435	250	82,565	53,739
	3	Condensing Boiler	9,804	6,383	4,321	3,164	43,939	32,204	280	184	58,345	41,935
Air Heating	4	Standard Efficiency Air Handling Units and Unit Heaters	1,588,915	823,362	649,659	362,194	353,043	195,528	135,572	68,121	2,727,189	1,449,204
	5	High-efficiency Air Handling Units and Unit heaters (Condensing)	319,495	208,188	157,397	109,897	64,440	44,711	14,842	9,318	556,173	372,113
	6	Radiant Tube Heating	732,737	527,570	195,514	151,717	99,120	76,587	34,113	24,562	1,061,483	780,436
			0	0	0	0	0	0	0	0	0	0
			0	0	0	0	0	0	0	0	0	0
			0	0	0	0	0	0	0	0	0	0
Process Heating			**14,515,238**	**9,670,492**	**10,796,194**	**7,672,056**	**5,727,811**	**3,727,020**	**722,685**	**429,471**	**31,761,928**	**21,499,039**
Boilers	1	Standard Efficiency Boiler	3,768,791	2,009,767	3,007,911	1,934,946	1,271,537	739,500	188,384	95,850	8,236,624	4,780,064
	2	Near Condensing Boiler	1,483,931	991,394	1,413,940	1,000,610	705,379	448,285	63,260	37,057	3,666,511	2,477,347
	3	Condensing Boiler	2,880,084	2,504,914	75,654	55,368	383,969	269,403	64,447	47,284	3,404,153	2,876,969
Water Heaters	4	Tank-type Water Heating	191,773	84,478	9,183	4,093	18,920	8,463	27,318	12,325	247,195	109,358
	5	Instantanious Water Heater	51,546	31,298	3,446	2,093	7,072	4,294	15,554	9,445	77,619	47,130
	6	Direct-fired Water Heating	230,630	144,605	82,286	51,594	41,298	25,894	10,090	6,327	364,305	228,419
Ovens	7	Standard Efficiency Oven	309,027	218,373	6,025	4,231	37,491	26,421	1,935	1,359	354,478	250,383
	8	Efficient Oven	218,118	179,803	4,953	4,093	29,829	24,674	1,935	1,597	254,835	210,166
Heat Treating	9	Standard Efficiency Heat Treating Furnace	563,405	225,198	160,099	64,033	29,576	11,787	6,180	2,356	759,260	303,373
	10	Heat Treating Furnace with Sequential Firing, High-velocity Burners	357,597	189,527	74,642	39,560	16,462	8,725	4,251	2,253	452,952	240,065
Lumber Kiln	11	Standard Efficiency Kiln	518,758	322,149	1,021,005	634,044	450,736	279,907	87,723	54,476	2,078,221	1,290,575
	12	High-efficiency Kiln	65,874	58,299	129,651	114,741	57,236	50,654	11,139	9,858	263,901	233,552
Veneer Dryers	13	Standard Efficiency Veneer Dryer	82,343	42,900	162,064	84,435	71,545	37,275	13,924	7,255	329,876	171,866
	14	Advanced Veneer Dryer	24,703	17,539	48,619	34,520	21,464	15,239	4,177	2,966	98,963	70,264
Paper	15	Direct-fired Paper Drying	169,122	148,151	770,127	674,631	171,986	150,660	1,666	1,460	1,112,902	974,902
Pulp Lime Kilns	16	Standard Efficiency Pulp Lime Kilns	335,538	253,331	2,299,780	1,736,334	512,778	387,147	0	0	3,148,096	2,376,812
	17	High-efficiency Pulp Lime Kilns	111,846	101,780	766,593	697,600	170,926	155,543	0	0	1,049,365	954,922
Cement Kilns	18	Standard Efficiency Cement Kilns	575,705	369,027	44,570	28,570	32,710	20,967	0	0	652,985	418,563
	19	High-efficiency Cement Kilns	51,248	41,767	1,779	1,450	16,355	13,329	0	0	69,383	56,547
Ore Drying	20	Standard Efficiency Ore Dryer	0	0	145,710	91,069	0	0	0	0	145,710	91,069
	21	High-efficiency Ore Dryer	0	0	0	0	0	0	0	0	0	0
Coal Drying	22	Standard Efficiency Coal Dryer	0	0	0	0	1,642,354	1,026,471	0	0	1,642,354	1,026,471
	23	High-efficiency Coal Dryer (with centrifuge)	0	0	0	0	0	0	0	0	0	0
Misc	24	Miscellaneous Standard Equipment	2,739	1,857	118	80	726	492	1,935	1,312	5,518	3,741
	25	Miscellaneous Efficient Equipment	2,739	2,238	118	96	726	593	1,935	1,581	5,518	4,508
Laundry	26	Direct-fired Gas Laundry Dryers	39,122	19,561	3,319	1,659	1,314	657	41,964	20,982	85,718	42,859
Direct-fired	27	Direct-fired Heating	1,669,699	901,638	331,290	178,896	32,140	17,356	132,901	71,766	2,166,030	1,169,656
Direct Consumption	28	Gas Consumed in Process	810,900	810,900	233,308	233,308	3,284	3,284	41,964	41,964	1,089,456	1,089,456
			0	0	0	0	0	0	0	0	0	0
			0	0	0	0	0	0	0	0	0	0
Total for Total Industrial Sector			**17,275,315**	**11,292,595**	**11,865,818**	**8,340,148**	**6,405,115**	**4,147,114**	**909,908**	**532,908**	**36,456,156**	**24,312,765**

Reference Case - Output for 2015

Total Industrial Sector			Lower Mainland		Northern Interior		Southern Interior		Vancouver Island		Total	
	#	Natural Gas Energy Conversion Device	Gas Sales (GJ)	Useful Heat (GJ)	Gas Sales (GJ)	Useful Heat (GJ)	Gas Sales (GJ)	Useful Heat (GJ)	Gas Sales (GJ)	Useful Heat (GJ)	Gas Sales (GJ)	Useful Heat (GJ)
Comfort Heat			**2,061,198**	**1,246,736**	**799,612**	**515,546**	**531,409**	**338,828**	**158,868**	**90,447**	**3,551,087**	**2,191,557**
Boilers	1	Standard Efficiency Boiler	79,998	41,872	32,223	21,015	55,188	32,861	1,683	884	169,092	96,633
	2	Near Condensing Boilers	15,920	9,574	14,244	10,210	40,631	27,208	404	240	71,199	47,231
	3	Condensing Boiler	10,557	7,021	4,288	3,220	37,626	28,104	288	192	52,758	38,537
Air Heating	4	Standard Efficiency Air Handling Units and Unit Heaters	1,109,641	588,719	453,231	258,088	262,007	148,341	110,321	56,794	1,935,200	1,051,942
	5	High-efficiency Air Handling Units and Unit heaters (Condensing)	257,822	171,438	124,495	88,541	54,792	38,729	15,077	9,669	452,186	308,376
	6	Radiant Tube Heating	587,260	428,112	171,132	134,473	81,165	63,586	31,095	22,669	870,652	648,839
			0	0	0	0	0	0	0	0	0	0
			0	0	0	0	0	0	0	0	0	0
			0	0	0	0	0	0	0	0	0	0
Process Heating			**11,705,600**	**7,976,632**	**8,142,391**	**5,891,765**	**4,595,717**	**3,035,213**	**599,467**	**365,403**	**25,043,175**	**17,269,013**
Boilers	1	Standard Efficiency Boiler	2,939,658	1,618,475	2,072,443	1,373,681	947,644	564,835	150,297	79,421	6,110,042	3,636,412
	2	Near Condensing Boiler	1,257,138	854,200	1,128,964	819,974	582,939	379,357	53,688	32,340	3,022,729	2,085,871
	3	Condensing Boiler	2,250,503	1,938,404	74,193	55,291	328,091	233,340	53,328	39,508	2,706,115	2,266,543
Water Heaters	4	Tank-type Water Heating	142,690	63,784	6,366	2,872	15,117	6,851	19,017	8,677	183,190	82,184
	5	Instantanious Water Heater	54,045	32,980	3,002	1,834	7,280	4,450	12,798	7,829	77,124	47,093
	6	Direct-fired Water Heating	210,041	135,188	76,653	49,336	38,344	24,679	9,323	5,943	334,362	215,146
Ovens	7	Standard Efficiency Oven	256,730	183,349	5,049	3,585	31,269	22,274	1,653	1,174	294,702	210,381
	8	Efficient Oven	215,025	178,382	4,819	4,006	28,995	24,128	1,887	1,566	250,726	208,083
Heat Treating	9	Standard Efficiency Heat Treating Furnace	307,793	129,133	87,259	36,643	16,338	6,825	3,966	1,566	415,357	174,167
	10	Heat Treating Furnace with Sequential Firing, High-velocity Burners	231,245	126,028	49,744	27,111	10,998	5,994	3,401	1,854	295,388	160,986
Lumber Kiln	11	Standard Efficiency Kiln	451,540	285,599	888,708	562,108	392,332	248,150	76,356	48,295	1,808,936	1,144,152
	12	High-efficiency Kiln	93,298	82,568	183,626	162,509	81,064	71,742	15,777	13,962	373,764	330,781
Veneer Dryers	13	Standard Efficiency Veneer Dryer	71,673	37,808	141,065	74,412	62,275	32,850	12,120	6,393	287,133	151,462
	14	Advanced Veneer Dryer	28,086	19,941	55,278	39,247	24,403	17,326	4,749	3,372	112,517	79,887
Paper	15	Direct-fired Paper Drying	118,913	104,346	541,866	475,488	121,066	106,235	1,503	1,319	783,348	687,388
Pulp Lime Kilns	16	Standard Efficiency Pulp Lime Kilns	226,343	170,889	1,551,359	1,171,276	345,904	261,157	0	0	2,123,606	1,603,322
	17	High-efficiency Pulp Lime Kilns	88,022	80,100	603,306	549,009	134,518	122,411	0	0	825,847	751,521
Cement Kilns	18	Standard Efficiency Cement Kilns	467,102	299,413	36,162	23,180	26,539	17,012	0	0	529,804	339,604
	19	High-efficiency Cement Kilns	62,776	51,162	3,011	2,454	14,928	12,167	0	0	80,715	65,783
Ore Drying	20	Standard Efficiency Ore Dryer	0	0	115,395	72,122	0	0	0	0	115,395	72,122
	21	High-efficiency Ore Dryer	0	0	4,808	3,734	0	0	0	0	4,808	3,734
Coal Drying	22	Standard Efficiency Coal Dryer	0	0	0	0	1,300,661	812,913	0	0	1,300,661	812,913
	23	High-efficiency Coal Dryer (with centrifuge)	0	0	0	0	54,194	42,082	0	0	54,194	42,082
Misc	24	Miscellaneous Standard Equipment	2,340	1,605	101	69	620	426	1,653	1,134	4,714	3,234
	25	Miscellaneous Efficient Equipment	2,671	2,193	115	94	708	581	1,887	1,549	5,381	4,418
Laundry	26	Direct-fired Gas Laundry Dryers	25,480	13,199	2,093	1,084	865	448	27,397	14,192	55,835	28,922
Direct-fired	27	Direct-fired Heating	1,442,273	807,673	287,176	160,819	26,462	14,819	121,270	67,911	1,877,182	1,051,222
Direct Consumption	28	Gas Consumed in Process	760,214	760,214	219,828	219,828	2,162	2,162	27,397	27,397	1,009,601	1,009,601
			0	0	0	0	0	0	0	0	0	0
			0	0	0	0	0	0	0	0	0	0
Total for Total Industrial Sector			**13,766,798**	**9,223,368**	**8,942,003**	**6,407,311**	**5,127,126**	**3,374,042**	**758,336**	**455,850**	**28,594,262**	**19,460,570**

Reference Case - Output for 2020

Total Industrial Sector

	#	Natural Gas Energy Conversion Device	Lower Mainland Gas Sales (GJ)	Lower Mainland Useful Heat (GJ)	Northern Interior Gas Sales (GJ)	Northern Interior Useful Heat (GJ)	Southern Interior Gas Sales (GJ)	Southern Interior Useful Heat (GJ)	Vancouver Island Gas Sales (GJ)	Vancouver Island Useful Heat (GJ)	Total Gas Sales (GJ)	Total Useful Heat (GJ)
Comfort Heat			**2,028,496**	**1,260,063**	**792,746**	**525,359**	**524,004**	**343,855**	**153,222**	**89,978**	**3,498,468**	**2,219,254**
Boilers	1	Standard Efficiency Boiler	76,511	41,471	30,849	20,758	52,812	32,487	1,608	875	161,780	95,591
	2	Near Condensing Boilers	17,496	10,805	14,895	10,947	41,736	28,676	436	266	74,565	50,694
	3	Condensing Boiler	12,183	8,272	4,953	3,806	38,756	29,491	321	219	56,213	41,788
Air Heating	4	Standard Efficiency Air Handling Units and Unit Heaters	1,040,987	566,036	425,967	247,968	244,105	141,335	101,002	53,255	1,812,061	1,008,594
	5	High-efficiency Air Handling Units and Unit heaters (Condensing)	286,020	194,148	135,607	98,285	60,682	43,726	17,218	11,277	499,527	347,436
	6	Radiant Tube Heating	595,298	439,330	180,475	143,595	85,912	68,140	32,636	24,085	894,321	675,150
			0	0	0	0	0	0	0	0	0	0
			0	0	0	0	0	0	0	0	0	0
			0	0	0	0	0	0	0	0	0	0
Process Heating			**11,561,142**	**8,082,798**	**8,126,750**	**6,011,977**	**4,589,272**	**3,098,306**	**591,526**	**372,203**	**24,868,690**	**17,565,285**
Boilers	1	Standard Efficiency Boiler	2,740,902	1,564,929	1,978,867	1,357,692	902,614	557,839	141,353	77,555	5,763,736	3,558,014
	2	Near Condensing Boiler	1,276,599	886,202	1,207,457	901,946	608,607	408,811	55,246	34,260	3,147,908	2,231,219
	3	Condensing Boiler	2,381,694	2,051,396	87,046	66,426	345,765	251,044	57,454	43,275	2,871,959	2,412,142
Water Heaters	4	Tank-type Water Heating	131,180	59,307	5,795	2,643	13,966	6,401	17,129	7,903	168,070	76,253
	5	Instantanious Water Heater	63,439	38,936	3,364	2,069	8,276	5,094	13,636	8,404	88,716	54,503
	6	Direct-fired Water Heating	210,041	138,680	76,653	50,610	38,344	25,317	9,323	6,096	334,362	220,703
Ovens	7	Standard Efficiency Oven	235,434	169,945	4,656	3,342	28,737	20,692	1,461	1,049	270,289	195,028
	8	Efficient Oven	232,034	193,698	5,146	4,304	30,954	25,913	1,906	1,591	270,039	225,506
Heat Treating	9	Standard Efficiency Heat Treating Furnace	272,025	119,567	77,119	33,927	14,439	6,320	3,505	1,455	367,088	161,269
	10	Heat Treating Furnace with Sequential Firing, High-velocity Burners	240,595	134,733	53,170	29,775	11,557	6,472	3,501	1,960	308,823	172,941
Lumber Kiln	11	Standard Efficiency Kiln	419,633	270,243	825,909	531,885	364,608	234,808	70,960	45,699	1,681,110	1,082,635
	12	High-efficiency Kiln	125,205	110,807	246,425	218,086	108,788	96,277	21,172	18,738	501,591	443,908
Veneer Dryers	13	Standard Efficiency Veneer Dryer	66,608	35,569	131,097	70,006	57,874	30,905	11,264	6,015	266,843	142,494
	14	Advanced Veneer Dryer	33,151	23,537	65,246	46,325	28,804	20,451	5,606	3,980	132,807	94,293
Paper	15	Direct-fired Paper Drying	118,192	103,891	542,414	476,782	121,228	106,560	1,835	1,613	783,669	688,845
Pulp Lime Kilns	16	Standard Efficiency Pulp Lime Kilns	216,912	163,769	1,486,719	1,122,473	331,491	250,276	0	0	2,035,122	1,536,517
	17	High-efficiency Pulp Lime Kilns	97,453	88,683	667,946	607,831	148,931	135,527	0	0	914,330	832,041
Cement Kilns	18	Standard Efficiency Cement Kilns	425,701	272,874	32,957	21,126	24,187	15,504	0	0	482,845	309,504
	19	High-efficiency Cement Kilns	78,208	63,739	4,296	3,501	15,248	12,427	0	0	97,752	79,668
Ore Drying	20	Standard Efficiency Ore Dryer	0	0	110,587	69,117	0	0	0	0	110,587	69,117
	21	High-efficiency Ore Dryer	0	0	9,616	7,467	0	0	0	0	9,616	7,467
Coal Drying	22	Standard Efficiency Coal Dryer	0	0	0	0	1,246,467	779,042	0	0	1,246,467	779,042
	23	High-efficiency Coal Dryer (with centrifuge)	0	0	0	0	108,388	84,164	0	0	108,388	84,164
Misc	24	Miscellaneous Standard Equipment	2,068	1,435	89	62	548	381	1,461	1,014	4,167	2,892
	25	Miscellaneous Efficient Equipment	2,697	2,225	116	96	715	590	1,906	1,572	5,434	4,483
Laundry	26	Direct-fired Gas Laundry Dryers	24,231	12,988	1,990	1,067	822	441	26,054	13,965	53,098	28,461
Direct-fired	27	Direct-fired Heating	1,408,321	816,826	282,497	163,848	25,856	14,997	120,700	70,006	1,837,375	1,065,677
Direct Consumption	28	Gas Consumed in Process	758,818	758,818	219,572	219,572	2,056	2,056	26,054	26,054	1,006,500	1,006,500
			0	0	0	0	0	0	0	0	0	0
			0	0	0	0	0	0	0	0	0	0
Total for Total Industrial Sector			**13,589,638**	**9,342,861**	**8,919,496**	**6,537,336**	**5,113,276**	**3,442,161**	**744,748**	**462,181**	**28,367,158**	**19,784,538**

Reference Case - Output for 2025

Total Industrial Sector			Lower Mainland		Northern Interior		Southern Interior		Vancouver Island		Total	
	#	Natural Gas Energy Conversion Device	Gas Sales (GJ)	Useful Heat (GJ)	Gas Sales (GJ)	Useful Heat (GJ)	Gas Sales (GJ)	Useful Heat (GJ)	Gas Sales (GJ)	Useful Heat (GJ)	Gas Sales (GJ)	Useful Heat (GJ)
Comfort Heat			**1,997,397**	**1,273,490**	**786,217**	**535,140**	**516,963**	**348,851**	**147,852**	**89,472**	**3,448,428**	**2,246,953**
Boilers	1	Standard Efficiency Boiler	73,045	40,975	29,480	20,457	50,447	32,042	1,533	863	154,505	94,337
	2	Near Condensing Boilers	19,071	12,092	15,547	11,709	42,841	30,189	468	294	77,926	54,284
	3	Condensing Boiler	13,805	9,566	5,617	4,409	39,884	30,908	355	247	59,661	45,130
Air Heating	4	Standard Efficiency Air Handling Units and Unit Heaters	973,946	542,487	399,239	237,498	226,850	134,266	92,237	49,789	1,692,272	964,040
	5	High-efficiency Air Handling Units and Unit heaters (Condensing)	313,712	217,317	146,573	108,230	66,399	48,761	19,206	12,842	545,891	387,150
	6	Radiant Tube Heating	603,818	451,052	189,760	152,836	90,542	72,686	34,052	25,437	918,173	702,011
			0	0	0	0	0	0	0	0	0	0
			0	0	0	0	0	0	0	0	0	0
			0	0	0	0	0	0	0	0	0	0
Process Heating			**11,423,765**	**8,184,880**	**8,111,875**	**6,130,487**	**4,583,143**	**3,160,610**	**583,974**	**378,810**	**24,702,757**	**17,854,787**
Boilers	1	Standard Efficiency Boiler	2,541,672	1,503,749	1,885,486	1,338,257	857,733	549,296	132,599	75,477	5,417,490	3,466,779
	2	Near Condensing Boiler	1,296,861	919,923	1,285,974	987,410	634,290	439,434	56,792	36,242	3,273,917	2,383,009
	3	Condensing Boiler	2,514,916	2,167,550	99,809	77,633	363,365	269,036	61,545	47,085	3,039,635	2,561,304
Water Heaters	4	Tank-type Water Heating	119,952	54,844	5,248	2,420	12,831	5,946	15,349	7,160	153,380	70,370
	5	Instantanious Water Heater	72,655	44,871	3,713	2,299	9,264	5,742	14,419	8,951	100,051	61,863
	6	Direct-fired Water Heating	210,041	142,172	76,653	51,885	38,344	25,954	9,323	6,250	334,362	226,260
Ovens	7	Standard Efficiency Oven	214,761	156,670	4,270	3,098	26,269	19,118	1,284	932	246,583	179,818
	8	Efficient Oven	248,630	208,831	5,470	4,602	32,877	27,686	1,918	1,611	288,894	242,731
Heat Treating	9	Standard Efficiency Heat Treating Furnace	239,022	109,841	67,763	31,166	12,687	5,807	3,080	1,340	322,553	148,155
	10	Heat Treating Furnace with Sequential Firing, High-velocity Burners	248,474	142,873	56,141	32,281	12,034	6,920	3,583	2,060	320,232	184,133
Lumber Kiln	11	Standard Efficiency Kiln	387,725	254,154	763,109	500,218	336,884	220,828	65,565	42,978	1,553,283	1,018,177
	12	High-efficiency Kiln	157,113	139,045	309,225	273,664	136,511	120,812	26,568	23,513	629,417	557,034
Veneer Dryers	13	Standard Efficiency Veneer Dryer	61,544	33,264	121,128	65,470	53,474	28,903	10,407	5,625	246,553	133,262
	14	Advanced Veneer Dryer	38,215	27,133	75,214	53,402	33,204	23,575	6,462	4,588	153,096	108,698
Paper	15	Direct-fired Paper Drying	117,507	103,465	542,914	478,035	121,376	106,871	2,166	1,907	783,963	690,279
Pulp Lime Kilns	16	Standard Efficiency Pulp Lime Kilns	207,481	156,648	1,422,079	1,073,670	317,078	239,394	0	0	1,946,639	1,469,712
	17	High-efficiency Pulp Lime Kilns	106,884	97,265	732,586	666,653	163,343	148,642	0	0	1,002,814	912,561
Cement Kilns	18	Standard Efficiency Cement Kilns	387,236	248,218	29,979	19,217	22,002	14,103	0	0	439,216	281,538
	19	High-efficiency Cement Kilns	91,977	74,961	5,448	4,440	15,501	12,633	0	0	112,926	92,035
Ore Drying	20	Standard Efficiency Ore Dryer	0	0	105,779	66,112	0	0	0	0	105,779	66,112
	21	High-efficiency Ore Dryer	0	0	14,424	11,201	0	0	0	0	14,424	11,201
Coal Drying	22	Standard Efficiency Coal Dryer	0	0	0	0	1,192,273	745,171	0	0	1,192,273	745,171
	23	High-efficiency Coal Dryer (with centrifuge)	0	0	0	0	162,583	126,245	0	0	162,583	126,245
Misc	24	Miscellaneous Standard Equipment	1,817	1,276	78	55	482	338	1,284	901	3,661	2,570
	25	Miscellaneous Efficient Equipment	2,714	2,250	117	97	720	597	1,918	1,590	5,469	4,534
Laundry	26	Direct-fired Gas Laundry Dryers	23,044	12,766	1,893	1,049	782	433	24,777	13,727	50,496	27,975
Direct-fired	27	Direct-fired Heating	1,376,033	825,620	278,047	166,828	25,280	15,168	120,158	72,095	1,799,518	1,079,711
Direct Consumption	28	Gas Consumed in Process	757,490	757,490	219,328	219,328	1,955	1,955	24,777	24,777	1,003,551	1,003,551
			0	0	0	0	0	0	0	0	0	0
			0	0	0	0	0	0	0	0	0	0
Total for Total Industrial Sector			**13,421,162**	**9,458,370**	**8,898,091**	**6,665,627**	**5,100,106**	**3,509,461**	**731,826**	**468,282**	**28,151,185**	**20,101,740**

Reference Case - Output for 2030

Total Industrial Sector			Lower Mainland		Northern Interior		Southern Interior		Vancouver Island		Total	
	#	Natural Gas Energy Conversion Device	Gas Sales (GJ)	Useful Heat (GJ)	Gas Sales (GJ)	Useful Heat (GJ)	Gas Sales (GJ)	Useful Heat (GJ)	Gas Sales (GJ)	Useful Heat (GJ)	Gas Sales (GJ)	Useful Heat (GJ)
Comfort Heat			**1,967,822**	**1,287,017**	**780,007**	**544,890**	**510,266**	**353,822**	**142,745**	**88,936**	**3,400,841**	**2,274,665**
Boilers	1	Standard Efficiency Boiler	69,597	40,381	28,114	20,109	48,091	31,523	1,459	850	147,262	92,863
	2	Near Condensing Boilers	20,643	13,435	16,198	12,499	43,944	31,748	500	322	81,285	58,004
	3	Condensing Boiler	15,423	10,902	6,280	5,031	41,009	32,354	388	276	63,101	48,563
Air Heating	4	Standard Efficiency Air Handling Units and Unit Heaters	908,413	518,066	373,014	226,674	210,200	127,130	83,987	46,393	1,575,615	918,263
	5	High-efficiency Air Handling Units and Unit heaters (Condensing)	340,936	240,948	157,407	118,378	71,956	53,836	21,053	14,366	591,352	427,528
	6	Radiant Tube Heating	612,810	463,284	198,995	162,200	95,065	77,230	35,356	26,729	942,225	729,444
			0	0	0	0	0	0	0	0	0	0
			0	0	0	0	0	0	0	0	0	0
			0	0	0	0	0	0	0	0	0	0
Process Heating			**11,293,120**	**8,282,682**	**8,097,729**	**6,247,283**	**4,577,315**	**3,222,103**	**576,792**	**385,223**	**24,544,956**	**18,137,290**
Boilers	1	Standard Efficiency Boiler	2,342,011	1,434,711	1,792,287	1,315,277	812,990	539,160	124,023	73,184	5,071,311	3,362,332
	2	Near Condensing Boiler	1,317,872	955,375	1,364,516	1,076,416	659,987	471,242	58,327	38,289	3,400,703	2,541,322
	3	Condensing Boiler	2,650,061	2,286,766	112,489	88,916	380,897	287,320	65,605	50,939	3,209,053	2,713,940
Water Heaters	4	Tank-type Water Heating	108,987	50,391	4,723	2,201	11,712	5,488	13,669	6,446	139,090	64,526
	5	Instantanious Water Heater	81,708	50,790	4,048	2,524	10,244	6,395	15,151	9,474	111,150	69,182
	6	Direct-fired Water Heating	210,041	145,664	76,653	53,159	38,344	26,592	9,323	6,403	334,362	231,818
Ovens	7	Standard Efficiency Oven	194,668	143,508	3,890	2,853	23,860	17,549	1,121	822	223,539	164,733
	8	Efficient Oven	264,845	223,802	5,790	4,900	34,767	29,451	1,924	1,626	307,326	259,780
Heat Treating	9	Standard Efficiency Heat Treating Furnace	208,602	100,034	59,139	28,382	11,073	5,290	2,688	1,223	281,501	134,929
	10	Heat Treating Furnace with Sequential Firing, High-velocity Burners	255,003	150,451	58,692	34,629	12,438	7,338	3,648	2,152	329,781	194,571
Lumber Kiln	11	Standard Efficiency Kiln	355,817	237,330	700,310	467,107	309,161	206,210	60,169	40,133	1,425,457	950,780
	12	High-efficiency Kiln	189,020	167,283	372,024	329,242	164,235	145,348	31,964	28,288	757,243	670,160
Veneer Dryers	13	Standard Efficiency Veneer Dryer	56,479	30,894	111,160	60,805	49,073	26,843	9,551	5,224	226,263	123,766
	14	Advanced Veneer Dryer	43,280	30,729	85,183	60,480	37,605	26,700	7,319	5,196	173,386	123,104
Paper	15	Direct-fired Paper Drying	116,855	103,066	543,369	479,251	121,509	107,171	2,498	2,203	784,231	691,692
Pulp Lime Kilns	16	Standard Efficiency Pulp Lime Kilns	198,050	149,528	1,357,439	1,024,866	302,666	228,513	0	0	1,858,155	1,402,907
	17	High-efficiency Pulp Lime Kilns	116,315	105,847	797,226	725,476	177,756	161,758	0	0	1,091,297	993,081
Cement Kilns	18	Standard Efficiency Cement Kilns	351,518	225,323	27,214	17,444	19,972	12,802	0	0	398,705	255,570
	19	High-efficiency Cement Kilns	104,208	84,929	6,477	5,279	15,692	12,789	0	0	126,377	102,998
Ore Drying	20	Standard Efficiency Ore Dryer	0	0	100,971	63,107	0	0	0	0	100,971	63,107
	21	High-efficiency Ore Dryer	0	0	19,233	14,934	0	0	0	0	19,233	14,934
Coal Drying	22	Standard Efficiency Coal Dryer	0	0	0	0	1,138,079	711,299	0	0	1,138,079	711,299
	23	High-efficiency Coal Dryer (with centrifuge)	0	0	0	0	216,777	168,327	0	0	216,777	168,327
Misc	24	Miscellaneous Standard Equipment	1,586	1,126	68	48	420	299	1,121	796	3,195	2,269
	25	Miscellaneous Efficient Equipment	2,724	2,269	117	98	722	602	1,924	1,603	5,487	4,571
Laundry	26	Direct-fired Gas Laundry Dryers	21,914	12,535	1,800	1,030	744	425	23,563	13,478	48,021	27,468
Direct-fired	27	Direct-fired Heating	1,345,328	834,103	273,815	169,765	24,732	15,334	119,642	74,178	1,763,517	1,093,381
Direct Consumption	28	Gas Consumed in Process	756,228	756,228	219,096	219,096	1,859	1,859	23,563	23,563	1,000,746	1,000,746
			0	0	0	0	0	0	0	0	0	0
			0	0	0	0	0	0	0	0	0	0
Total for Total Industrial Sector			**13,260,942**	**9,569,698**	**8,877,736**	**6,792,173**	**5,087,581**	**3,575,924**	**719,537**	**474,159**	**27,945,797**	**20,411,955**

Reference Case Sub sector Forecast Consumption and Market Share by Technology

ALL SERVICE AREAS

		AGRICULTURE		2010				2015				2020				2025				2030			
				Annual Sales		Annual Useful Heat		Annual Sales		Annual Useful Heat		Annual Sales		Annual Useful Heat		Annual Sales		Annual Useful Heat		Annual Sales		Annual Useful Heat	
				Market Share	Total Sales	Overall Efficiency	Total Useful Heat	Market Share	Total Sales	Overall Efficiency	Total Useful Heat	Market Share	Total Sales	Overall Efficiency	Total Useful Heat	Market Share	Total Sales	Overall Efficiency	Total Useful Heat	Market Share	Total Sales	Overall Efficiency	Total Useful Heat
	END USE	TECHNOLOGY		(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)
COMFORT HEATING	Boilers	1	Standard Efficiency Boiler	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		2	Near Condensing Boilers	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		3	Condensing Boiler	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Air Heating	4	Standard Efficiency Air Handling Units and Unit Heaters	14%	633,268	55%	348,804	14%	436,824	57%	250,033	13%	424,685	59%	252,344	13%	410,838	62%	253,161	13%	395,395	64%	252,432
		5	High-efficiency Air Handling Units and Unit heaters (Condensing)	4%	180,934	68%	123,107	4%	142,871	70%	100,482	5%	158,414	73%	115,046	6%	174,347	75%	130,617	6%	190,637	77%	147,197
		6	Radiant Tube Heating	2%	90,467	56%	51,064	2%	77,183	58%	44,636	3%	91,004	59%	53,890	3%	105,299	61%	63,817	4%	120,031	62%	74,413

	END USE	TECHNOLOGY																					
PROCESS HEATING	Boilers	1	Standard Efficiency Boiler	15%	686,110	55%	377,993	12%	390,826	59%	229,093	9%	295,450	62%	183,887	6%	198,445	66%	130,890	3%	99,925	70%	69,720
		2	Near Condensing Boiler	6%	289,429	74%	213,985	5%	161,236	77%	124,760	4%	119,321	81%	96,496	2%	78,529	81%	63,998	1%	38,780	82%	31,822
		3	Condensing Boiler	57%	2,569,961	90%	2,320,888	60%	1,916,858	90%	1,727,589	64%	2,021,361	90%	1,818,302	68%	2,127,978	90%	1,910,769	71%	2,236,594	90%	2,004,901
	Water Heaters	4	Tank-type Water Heating	2%	72,357	42%	30,314	1%	47,061	43%	20,180	1%	43,154	44%	18,934	1%	39,363	45%	17,666	1%	35,678	46%	16,374
		5	Instantaneous Water Heater	0%	0	0%	0	0%	3,325	59%	1,958	0%	6,563	60%	3,924	0%	9,718	61%	5,901	0%	12,798	62%	7,888
		6	Direct-fired Water Heating	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Ovens	7	Standard Efficiency Oven	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		8	Efficient Oven	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Heat Treating	9	Standard Efficiency Heat Treating Furnace	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		10	Heat Treating Furnace with Sequential Firing, High-velocity Burners	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Lumber Kiln	11	Standard Efficiency Kiln	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		12	High-efficiency Kiln	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Veneer Dryers	13	Standard Efficiency Veneer Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		14	Advanced Veneer Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Paper	15	Direct-fired Paper Drying	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Pulp Lime Kilns	16	Standard Efficiency Pulp Lime Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		17	High-efficiency Pulp Lime Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Cement Kilns	18	Standard Efficiency Cement Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		19	High-efficiency Cement Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Ore Drying	20	Standard Efficiency Ore Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		21	High-efficiency Ore Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Coal Drying	22	Standard Efficiency Coal Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		23	High-efficiency Coal Dryer (with centrifuge)	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Miscellaneous	24	Miscellaneous Standard Equipment	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		25	Miscellaneous Efficient Equipment	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Laundry	26	Direct-fired Gas Laundry Dryers	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Direct-fired	27	Direct-fired Heating	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Direct Consumption	28	Gas Consumed in Process	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Total			**100%**	**4,522,525**		**3,466,156**	**100%**	**3,176,184**		**2,498,731**	**100%**	**3,159,952**		**2,542,824**	**100%**	**3,144,517**		**2,576,819**	**100%**	**3,129,837**		**2,604,748**

Reference Case Sub sector Forecast Consumption and Market Share by Technology

ALL SERVICE AREAS

CHEMICAL

				2010				2015				2020				2025				2030			
				Annual Sales		Annual Useful Heat		Annual Sales		Annual Useful Heat		Annual Sales		Annual Useful Heat		Annual Sales		Annual Useful Heat		Annual Sales		Annual Useful Heat	
				Market Share	Total Sales	Overall Efficiency	Total Useful Heat	Market Share	Total Sales	Overall Efficiency	Total Useful Heat	Market Share	Total Sales	Overall Efficiency	Total Useful Heat	Market Share	Total Sales	Overall Efficiency	Total Useful Heat	Market Share	Total Sales	Overall Efficiency	Total Useful Heat
	END USE	TECHNOLOGY		(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)
COMFORT HEATING	Boilers	1	Standard Efficiency Boiler	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		2	Near Condensing Boilers	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		3	Condensing Boiler	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Air Heating	4	Standard Efficiency Air Handling Units and Unit Heaters	4%	153,781	52%	79,988	4%	139,330	54%	75,434	4%	131,996	56%	74,297	4%	124,663	58%	72,870	3%	117,330	61%	71,149
		5	High-efficiency Air Handling Units and Unit heaters (Condensing)	0%	0	0%	0	0%	3,667	67%	2,465	0%	7,333	70%	5,097	0%	11,000	72%	7,897	0%	14,666	74%	10,865
		6	Radiant Tube Heating	2%	76,567	61%	46,503	2%	76,690	62%	47,541	2%	80,356	63%	50,833	2%	84,023	65%	54,229	3%	87,690	66%	57,727
	END USE	TECHNOLOGY																					
PROCESS HEATING	Boilers	1	Standard Efficiency Boiler	14%	483,488	58%	278,101	12%	414,998	61%	254,142	11%	368,887	65%	239,974	10%	322,776	69%	222,593	8%	276,665	73%	201,870
		2	Near Condensing Boiler	18%	620,107	71%	440,134	18%	614,460	74%	456,970	19%	637,515	78%	496,112	20%	660,571	81%	537,221	20%	683,626	85%	580,332
		3	Condensing Boiler	3%	109,606	75%	82,718	4%	127,588	78%	99,152	4%	150,643	80%	120,910	5%	173,699	83%	144,161	6%	196,754	86%	168,908
	Water Heaters	4	Tank-type Water Heating	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		5	Instantaneous Water Heater	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		6	Direct-fired Water Heating	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Ovens	7	Standard Efficiency Oven	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		8	Efficient Oven	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Heat Treating	9	Standard Efficiency Heat Treating Furnace	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		10	Heat Treating Furnace with Sequential Firing, High-velocity Burners	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Lumber Kiln	11	Standard Efficiency Kiln	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		12	High-efficiency Kiln	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Veneer Dryers	13	Standard Efficiency Veneer Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		14	Advanced Veneer Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Paper	15	Direct-fired Paper Drying	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Pulp Lime Kilns	16	Standard Efficiency Pulp Lime Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		17	High-efficiency Pulp Lime Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Cement Kilns	18	Standard Efficiency Cement Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		19	High-efficiency Cement Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Ore Drying	20	Standard Efficiency Ore Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		21	High-efficiency Ore Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Coal Drying	22	Standard Efficiency Coal Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		23	High-efficiency Coal Dryer (with centrifuge)	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Miscellaneous	24	Miscellaneous Standard Equipment	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		25	Miscellaneous Efficient Equipment	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Laundry	26	Direct-fired Gas Laundry Dryers	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Direct-fired	27	Direct-fired Heating	31%	1,104,865	54%	596,627	31%	1,053,724	56%	590,085	31%	1,053,724	58%	611,160	31%	1,053,724	60%	632,234	31%	1,053,724	62%	653,309
	Direct Consumption	28	Gas Consumed in Process	28%	992,252	100%	992,252	28%	946,323	100%	946,323	28%	946,323	100%	946,323	28%	946,323	100%	946,323	28%	946,323	100%	946,323
	Total			**100%**	**3,540,666**		**2,516,323**	**100%**	**3,376,779**		**2,472,112**	**100%**	**3,376,779**		**2,544,706**	**100%**	**3,376,779**		**2,617,530**	**100%**	**3,376,779**		**2,690,482**

Reference Case Sub sector Forecast Consumption and Market Share by Technology

ALL SERVICE AREAS

FABRICATED METAL

			2010				2015				2020				2025				2030			
			Annual Sales		Annual Useful Heat		Annual Sales		Annual Useful Heat		Annual Sales		Annual Useful Heat		Annual Sales		Annual Useful Heat		Annual Sales		Annual Useful Heat	
			Market Share	Total Sales	Overall Efficiency	Total Useful Heat	Market Share	Total Sales	Overall Efficiency	Total Useful Heat	Market Share	Total Sales	Overall Efficiency	Total Useful Heat	Market Share	Total Sales	Overall Efficiency	Total Useful Heat	Market Share	Total Sales	Overall Efficiency	Total Useful Heat
END USE		TECHNOLOGY	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)
COMFORT HEATING																						
Boilers	1	Standard Efficiency Boiler	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	2	Near Condensing Boilers	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	3	Condensing Boiler	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
Air Heating	4	Standard Efficiency Air Handling Units and Unit Heaters	15%	341,195	51%	173,491	14%	189,069	53%	100,146	13%	170,339	55%	93,871	13%	152,991	57%	87,615	12%	136,935	59%	81,405
	5	High-efficiency Air Handling Units and Unit heaters (Condensing)	3%	69,202	63%	43,919	3%	45,341	66%	29,813	4%	47,851	68%	32,558	4%	50,005	70%	35,169	4%	51,834	73%	37,640
	6	Radiant Tube Heating	12%	281,626	57%	159,383	13%	169,249	58%	98,154	13%	165,685	59%	98,408	13%	162,065	61%	98,527	14%	158,401	62%	98,518

END USE		TECHNOLOGY																				
PROCESS HEATING																						
Boilers	1	Standard Efficiency Boiler	4%	86,311	54%	46,593	3%	45,311	58%	26,077	3%	38,302	61%	23,447	3%	31,872	65%	20,708	2%	25,980	69%	17,881
	2	Near Condensing Boiler	3%	64,733	72%	46,293	3%	40,276	75%	30,217	3%	40,696	79%	31,981	3%	40,978	79%	32,472	4%	41,135	80%	32,867
	3	Condensing Boiler	0%	0	0%	0	0%	2,517	54%	1,355	0%	4,788	57%	2,731	1%	6,830	60%	4,116	1%	8,660	63%	5,497
Water Heaters	4	Tank-type Water Heating	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	5	Instantaneous Water Heater	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	6	Direct-fired Water Heating	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
Ovens	7	Standard Efficiency Oven	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	8	Efficient Oven	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
Heat Treating	9	Standard Efficiency Heat Treating Furnace	33%	753,742	40%	301,497	27%	367,116	43%	156,024	22%	280,135	45%	126,061	17%	200,798	48%	95,379	11%	128,565	50%	64,283
	10	Heat Treating Furnace with Sequential Firing, High-velocity Burners	19%	447,434	53%	237,140	25%	333,533	55%	181,776	30%	386,175	56%	216,258	36%	432,856	58%	248,892	41%	474,034	59%	279,680
Lumber Kiln	11	Standard Efficiency Kiln	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	12	High-efficiency Kiln	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
Veneer Dryers	13	Standard Efficiency Veneer Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	14	Advanced Veneer Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
Paper	15	Direct-fired Paper Drying	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
Pulp Lime Kilns	16	Standard Efficiency Pulp Lime Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	17	High-efficiency Pulp Lime Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
Cement Kilns	18	Standard Efficiency Cement Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	19	High-efficiency Cement Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
Ore Drying	20	Standard Efficiency Ore Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	21	High-efficiency Ore Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
Coal Drying	22	Standard Efficiency Coal Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	23	High-efficiency Coal Dryer (with centrifuge)	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
Miscellaneous	24	Miscellaneous Standard Equipment	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	25	Miscellaneous Efficient Equipment	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
Laundry	26	Direct-fired Gas Laundry Dryers	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
Direct-fired	27	Direct-fired Heating	11%	253,613	54%	136,951	11%	147,933	56%	82,843	11%	140,683	58%	81,596	11%	133,788	60%	80,273	11%	127,231	62%	78,883
Direct Consumption	28	Gas Consumed in Process	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
Total			**100%**	**2,297,858**		**1,145,267**	**100%**	**1,340,346**		**706,405**	**100%**	**1,274,656**		**706,911**	**100%**	**1,212,185**		**703,152**	**100%**	**1,152,776**		**696,655**

Reference Case Sub sector Forecast Consumption and Market Share by Technology

ALL SERVICE AREAS

FOOD & BEVERAGE

	END USE		TECHNOLOGY	2010 Annual Sales Market Share (%)	2010 Annual Sales Total Sales (GJ)	2010 Annual Useful Heat Overall Efficiency (%)	2010 Annual Useful Heat Total Useful Heat (GJ)	2015 Annual Sales Market Share (%)	2015 Annual Sales Total Sales (GJ)	2015 Annual Useful Heat Overall Efficiency (%)	2015 Annual Useful Heat Total Useful Heat (GJ)	2020 Annual Sales Market Share (%)	2020 Annual Sales Total Sales (GJ)	2020 Annual Useful Heat Overall Efficiency (%)	2020 Annual Useful Heat Total Useful Heat (GJ)	2025 Annual Sales Market Share (%)	2025 Annual Sales Total Sales (GJ)	2025 Annual Useful Heat Overall Efficiency (%)	2025 Annual Useful Heat Total Useful Heat (GJ)	2030 Annual Sales Market Share (%)	2030 Annual Sales Total Sales (GJ)	2030 Annual Useful Heat Overall Efficiency (%)	2030 Annual Useful Heat Total Useful Heat (GJ)	
COMFORT HEATING	Boilers	1	Standard Efficiency Boiler	2%	103,911	51%	53,177	2%	84,740	54%	45,730	2%	75,325	57%	42,801	2%	65,909	60%	39,378	1%	56,494	63%	35,443	COMFORT HEATING
		2	Near Condensing Boilers	0%	15,218	59%	8,927	0%	18,498	61%	11,323	1%	23,205	64%	14,808	1%	27,913	66%	18,547	1%	32,621	69%	22,546	
		3	Condensing Boiler	0%	12,273	67%	8,218	0%	15,829	69%	10,933	1%	20,537	71%	14,637	1%	25,245	74%	18,559	1%	29,952	76%	22,700	
	Air Heating	4	Standard Efficiency Air Handling Units and Unit Heaters	6%	237,246	52%	123,554	5%	204,225	54%	110,701	5%	193,477	56%	109,028	5%	182,728	59%	106,930	4%	171,979	61%	104,401	
		5	High-efficiency Air Handling Units and Unit heaters (Condensing)	1%	21,532	65%	13,937	1%	24,885	67%	16,691	1%	30,259	69%	21,000	1%	35,634	72%	25,555	1%	41,008	74%	30,356	
		6	Radiant Tube Heating	1%	40,459	58%	23,392	1%	42,035	59%	24,890	1%	47,409	61%	28,734	1%	52,784	62%	32,729	1%	58,158	63%	36,875	

	END USE		TECHNOLOGY	2010 Market Share (%)	2010 Total Sales (GJ)	2010 Overall Efficiency (%)	2010 Total Useful Heat (GJ)	2015 Market Share (%)	2015 Total Sales (GJ)	2015 Overall Efficiency (%)	2015 Total Useful Heat (GJ)	2020 Market Share (%)	2020 Total Sales (GJ)	2020 Overall Efficiency (%)	2020 Total Useful Heat (GJ)	2025 Market Share (%)	2025 Total Sales (GJ)	2025 Overall Efficiency (%)	2025 Total Useful Heat (GJ)	2030 Market Share (%)	2030 Total Sales (GJ)	2030 Overall Efficiency (%)	2030 Total Useful Heat (GJ)	
PROCESS HEATING	Boilers	1	Standard Efficiency Boiler	50%	2,168,635	50%	1,080,545	45%	1,768,543	53%	942,964	40%	1,572,038	57%	894,581	35%	1,375,533	61%	833,400	30%	1,179,029	64%	758,865	PROCESS HEATING
		2	Near Condensing Boiler	11%	490,839	58%	282,320	12%	474,686	61%	288,926	13%	504,612	64%	324,308	14%	534,538	68%	362,006	14%	564,464	71%	402,064	
		3	Condensing Boiler	8%	356,743	65%	232,364	9%	353,179	68%	241,257	10%	383,105	71%	273,908	11%	413,031	75%	308,503	11%	442,956	78%	345,042	
	Water Heaters	4	Tank-type Water Heating	3%	119,499	45%	54,025	3%	101,134	46%	46,754	2%	93,988	47%	44,419	2%	86,841	48%	41,944	2%	79,695	49%	39,329	
		5	Instantaneous Water Heater	1%	47,800	61%	29,024	1%	50,459	62%	31,103	1%	57,605	63%	36,038	2%	64,752	63%	41,104	2%	71,898	64%	46,303	
		6	Direct-fired Water Heating	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	
	Ovens	7	Standard Efficiency Oven	6%	255,117	70%	177,817	5%	193,025	71%	136,661	4%	154,882	72%	111,360	3%	116,739	73%	85,220	2%	78,597	74%	58,240	
		8	Efficient Oven	5%	231,971	82%	191,026	6%	248,336	83%	205,750	7%	286,479	83%	238,788	8%	324,622	84%	272,208	9%	362,764	84%	306,010	
	Heat Treating	9	Standard Efficiency Heat Treating Furnace	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	
		10	Heat Treating Furnace with Sequential Firing, High-velocity Burners	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	
	Lumber Kiln	11	Standard Efficiency Kiln	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	
		12	High-efficiency Kiln	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	
	Veneer Dryers	13	Standard Efficiency Veneer Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	
		14	Advanced Veneer Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	
	Paper	15	Direct-fired Paper Drying	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	
	Pulp Lime Kilns	16	Standard Efficiency Pulp Lime Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	
		17	High-efficiency Pulp Lime Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	
	Cement Kilns	18	Standard Efficiency Cement Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	
		19	High-efficiency Cement Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	
	Ore Drying	20	Standard Efficiency Ore Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	
		21	High-efficiency Ore Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	
	Coal Drying	22	Standard Efficiency Coal Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	
		23	High-efficiency Coal Dryer (with centrifuge)	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	
	Miscellaneous	24	Miscellaneous Standard Equipment	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	
		25	Miscellaneous Efficient Equipment	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	
	Laundry	26	Direct-fired Gas Laundry Dryers	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	
	Direct-fired	27	Direct-fired Heating	5%	199,366	54%	107,658	8%	317,303	55%	175,283	12%	453,956	57%	258,482	15%	590,609	59%	347,146	19%	727,262	61%	441,277	
	Direct Consumption	28	Gas Consumed in Process	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	
	Total			**100%**	**4,300,611**		**2,385,984**	**100%**	**3,896,877**		**2,288,967**	**100%**	**3,896,877**		**2,412,891**	**100%**	**3,896,877**		**2,533,231**	**100%**	**3,896,877**		**2,649,450**	

Reference Case Sub sector Forecast Consumption and Market Share by Technology

ALL SERVICE AREAS

MINING

	END USE		TECHNOLOGY	2010				2015				2020				2025				2030			
				Annual Sales		Annual Useful Heat		Annual Sales		Annual Useful Heat		Annual Sales		Annual Useful Heat		Annual Sales		Annual Useful Heat		Annual Sales		Annual Useful Heat	
				Market Share	Total Sales	Overall Efficiency	Total Useful Heat	Market Share	Total Sales	Overall Efficiency	Total Useful Heat	Market Share	Total Sales	Overall Efficiency	Total Useful Heat	Market Share	Total Sales	Overall Efficiency	Total Useful Heat	Market Share	Total Sales	Overall Efficiency	Total Useful Heat
				(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)
COMFORT HEATING	Boilers	1	Standard Efficiency Boiler	2%	58,897	57%	33,290	2%	43,728	59%	25,982	2%	38,869	62%	24,246	1%	34,011	65%	22,245	1%	29,152	69%	19,969
		2	Near Condensing Boilers	2%	48,334	65%	31,296	2%	42,303	67%	28,493	2%	44,732	70%	31,312	2%	47,161	73%	34,277	2%	49,591	75%	37,389
		3	Condensing Boiler	1%	44,814	73%	32,854	2%	39,398	76%	29,788	2%	41,828	78%	32,586	2%	44,257	80%	35,496	2%	46,686	83%	38,519
	Air Heating	4	Standard Efficiency Air Handling Units and Unit Heaters	1%	28,594	55%	15,748	1%	22,409	57%	12,822	1%	21,229	59%	12,607	1%	20,050	62%	12,344	1%	18,871	64%	12,033
		5	High-efficiency Air Handling Units and Unit heaters (Condensing)	0%	10,562	68%	7,215	0%	9,303	71%	6,570	0%	9,893	73%	7,216	0%	10,482	75%	7,888	0%	11,072	78%	8,587
		6	Radiant Tube Heating	1%	28,594	61%	17,341	1%	24,178	61%	14,752	1%	24,768	61%	15,202	1%	25,357	62%	15,657	1%	25,947	62%	16,116

	END USE		TECHNOLOGY	2010				2015				2020				2025				2030			
PROCESS HEATING	Boilers	1	Standard Efficiency Boiler	13%	397,348	51%	203,943	12%	295,012	55%	161,876	10%	262,233	59%	153,433	9%	229,454	62%	142,822	8%	196,675	66%	129,948
		2	Near Condensing Boiler	12%	368,966	59%	216,467	13%	320,767	62%	199,183	13%	337,156	66%	221,080	14%	353,546	69%	244,290	15%	369,935	73%	268,837
		3	Condensing Boiler	9%	283,820	66%	185,950	10%	250,526	69%	172,274	11%	266,915	72%	192,213	11%	283,305	75%	213,218	12%	299,694	79%	235,287
	Water Heaters	4	Tank-type Water Heating	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		5	Instantaneous Water Heater	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		6	Direct-fired Water Heating	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Ovens	7	Standard Efficiency Oven	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		8	Efficient Oven	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Heat Treating	9	Standard Efficiency Heat Treating Furnace	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		10	Heat Treating Furnace with Sequential Firing, High-velocity Burners	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Lumber Kiln	11	Standard Efficiency Kiln	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		12	High-efficiency Kiln	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Veneer Dryers	13	Standard Efficiency Veneer Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		14	Advanced Veneer Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Paper	15	Direct-fired Paper Drying	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Pulp Lime Kilns	16	Standard Efficiency Pulp Lime Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		17	High-efficiency Pulp Lime Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Cement Kilns	18	Standard Efficiency Cement Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		19	High-efficiency Cement Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Ore Drying	20	Standard Efficiency Ore Dryer	5%	145,710	63%	91,069	4%	108,183	66%	70,995	4%	96,163	69%	66,112	3%	84,142	72%	60,477	3%	72,122	75%	54,091
		21	High-efficiency Ore Dryer	0%	0	0%	0	0%	12,020	78%	9,358	1%	24,041	78%	18,764	1%	36,061	78%	28,218	2%	48,081	78%	37,720
	Coal Drying	22	Standard Efficiency Coal Dryer	53%	1,642,354	63%	1,026,471	48%	1,219,370	66%	800,212	43%	1,083,884	69%	745,171	37%	948,399	72%	681,662	32%	812,913	75%	609,685
		23	High-efficiency Coal Dryer (with centrifuge)	0%	0	0%	0	5%	135,486	78%	105,476	11%	270,971	78%	211,493	16%	406,457	78%	318,052	21%	541,942	78%	425,154
	Miscellaneous	24	Miscellaneous Standard Equipment	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		25	Miscellaneous Efficient Equipment	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Laundry	26	Direct-fired Gas Laundry Dryers	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Direct-fired	27	Direct-fired Heating	0%	13,610	54%	7,349	0%	11,228	56%	6,287	0%	11,228	58%	6,512	0%	11,228	60%	6,737	0%	11,228	62%	6,961
	Direct Consumption	28	Gas Consumed in Process	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Total			**100%**	**3,071,601**		**1,868,994**	**100%**	**2,533,909**		**1,644,067**	**100%**	**2,533,909**		**1,737,945**	**100%**	**2,533,909**		**1,823,381**	**100%**	**2,533,909**		**1,900,297**

Reference Case Sub sector Forecast Consumption and Market Share by Technology

ALL SERVICE AREAS

MISCELLANEOUS MANUFACTURING

COMFORT HEATING

			2010				2015				2020				2025				2030			
			Annual Sales		Annual Useful Heat		Annual Sales		Annual Useful Heat		Annual Sales		Annual Useful Heat		Annual Sales		Annual Useful Heat		Annual Sales		Annual Useful Heat	
			Market Share	Total Sales	Overall Efficiency	Total Useful Heat	Market Share	Total Sales	Overall Efficiency	Total Useful Heat	Market Share	Total Sales	Overall Efficiency	Total Useful Heat	Market Share	Total Sales	Overall Efficiency	Total Useful Heat	Market Share	Total Sales	Overall Efficiency	Total Useful Heat
END USE	TECHNOLOGY		(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)
Boilers	1	Standard Efficiency Boiler	2%	6,159	53%	3,279	1%	5,071	56%	2,843	1%	4,286	59%	2,528	1%	3,567	62%	2,209	1%	2,907	65%	1,889
	2	Near Condensing Boilers	1%	3,080	61%	1,871	1%	3,099	63%	1,963	1%	3,215	66%	2,121	1%	3,312	69%	2,273	1%	3,392	71%	2,419
	3	Condensing Boiler	0%	1,232	69%	846	0%	1,409	71%	1,000	0%	1,607	73%	1,178	1%	1,783	76%	1,349	1%	1,938	78%	1,511
Air Heating	4	Standard Efficiency Air Handling Units and Unit Heaters	8%	30,797	52%	16,140	8%	26,762	55%	14,595	7%	24,111	57%	13,667	7%	21,655	59%	12,745	6%	19,383	61%	11,832
	5	High-efficiency Air Handling Units and Unit heaters (Condensing)	2%	8,007	65%	5,238	2%	8,029	68%	5,436	2%	8,305	70%	5,813	3%	8,535	72%	6,169	3%	8,722	75%	6,504
	6	Radiant Tube Heating	73%	283,867	56%	159,224	73%	260,362	57%	149,699	73%	248,272	59%	146,237	74%	236,741	60%	142,772	74%	225,744	62%	139,313

PROCESS HEATING

END USE	TECHNOLOGY		2010 Market Share	2010 Total Sales	2010 Overall Efficiency	2010 Total Useful Heat	2015 Market Share	2015 Total Sales	2015 Overall Efficiency	2015 Total Useful Heat	2020 Market Share	2020 Total Sales	2020 Overall Efficiency	2020 Total Useful Heat	2025 Market Share	2025 Total Sales	2025 Overall Efficiency	2025 Total Useful Heat	2030 Market Share	2030 Total Sales	2030 Overall Efficiency	2030 Total Useful Heat
Boilers	1	Standard Efficiency Boiler	2%	8,277	51%	4,205	2%	6,814	54%	3,701	2%	5,760	58%	3,337	1%	4,793	62%	2,954	1%	3,907	65%	2,557
	2	Near Condensing Boiler	1%	2,759	58%	1,599	1%	2,902	61%	1,781	1%	3,120	65%	2,022	1%	3,310	68%	2,260	1%	3,473	72%	2,494
	3	Condensing Boiler	0%	0	0%	0	0%	379	69%	260	0%	720	72%	519	0%	1,027	75%	773	0%	1,302	79%	1,022
Water Heaters	4	Tank-type Water Heating	1%	5,518	45%	2,495	1%	4,714	46%	2,180	1%	4,167	47%	1,969	1%	3,661	48%	1,768	1%	3,195	49%	1,577
	5	Instantaneous Water Heater	1%	5,518	61%	3,351	2%	5,381	62%	3,317	2%	5,434	63%	3,399	2%	5,469	63%	3,472	2%	5,487	64%	3,534
	6	Direct-fired Water Heating	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
Ovens	7	Standard Efficiency Oven	1%	5,518	70%	3,874	1%	4,215	71%	3,005	1%	3,216	72%	2,328	1%	2,305	74%	1,694	0%	1,476	75%	1,101
	8	Efficient Oven	1%	5,518	83%	4,553	2%	5,880	83%	4,881	2%	6,384	84%	5,331	2%	6,825	84%	5,733	2%	7,206	85%	6,089
Heat Treating	9	Standard Efficiency Heat Treating Furnace	1%	5,518	34%	1,876	1%	4,215	37%	1,538	1%	3,216	39%	1,254	1%	2,305	42%	957	0%	1,476	44%	649
	10	Heat Treating Furnace with Sequential Firing, High-velocity Burners	1%	5,518	53%	2,925	2%	5,880	55%	3,205	2%	6,384	56%	3,575	2%	6,825	58%	3,924	2%	7,206	59%	4,252
Lumber Kiln	11	Standard Efficiency Kiln	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	12	High-efficiency Kiln	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
Veneer Dryers	13	Standard Efficiency Veneer Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	14	Advanced Veneer Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
Paper	15	Direct-fired Paper Drying	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
Pulp Lime Kilns	16	Standard Efficiency Pulp Lime Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	17	High-efficiency Pulp Lime Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
Cement Kilns	18	Standard Efficiency Cement Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	19	High-efficiency Cement Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
Ore Drying	20	Standard Efficiency Ore Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	21	High-efficiency Ore Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
Coal Drying	22	Standard Efficiency Coal Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	23	High-efficiency Coal Dryer (with centrifuge)	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
Miscellaneous	24	Miscellaneous Standard Equipment	1%	5,518	68%	3,741	1%	4,215	69%	2,904	1%	3,216	70%	2,251	1%	2,305	71%	1,639	0%	1,476	72%	1,066
	25	Miscellaneous Efficient Equipment	1%	5,518	82%	4,508	2%	5,880	82%	4,837	2%	6,384	83%	5,286	2%	6,825	83%	5,688	2%	7,206	84%	6,046
Laundry	26	Direct-fired Gas Laundry Dryers	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
Direct-fired	27	Direct-fired Heating	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
Direct Consumption	28	Gas Consumed in Process	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
Total			**100%**	**388,324**		**219,725**	**100%**	**355,207**		**207,145**	**100%**	**337,798**		**202,816**	**100%**	**321,243**		**198,380**	**100%**	**305,499**		**193,856**

Reference Case Sub sector Forecast Consumption and Market Share by Technology

ALL SERVICE AREAS

NON-METAL MANUFACTURING

	END USE		TECHNOLOGY	2010				2015				2020				2025				2030			
				Annual Sales		Annual Useful Heat		Annual Sales		Annual Useful Heat		Annual Sales		Annual Useful Heat		Annual Sales		Annual Useful Heat		Annual Sales		Annual Useful Heat	
				Market Share	Total Sales	Overall Efficiency	Total Useful Heat	Market Share	Total Sales	Overall Efficiency	Total Useful Heat	Market Share	Total Sales	Overall Efficiency	Total Useful Heat	Market Share	Total Sales	Overall Efficiency	Total Useful Heat	Market Share	Total Sales	Overall Efficiency	Total Useful Heat
				(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)
COMFORT HEATING	Boilers	1	Standard Efficiency Boiler	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		2	Near Condensing Boilers	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		3	Condensing Boiler	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Air Heating	4	Standard Efficiency Air Handling Units and Unit Heaters	15%	322,615	51%	164,054	15%	259,030	53%	137,212	14%	233,370	55%	128,613	13%	209,603	57%	120,042	12%	187,605	59%	111,534
		5	High-efficiency Air Handling Units and Unit heaters (Condensing)	2%	46,088	63%	29,255	3%	45,768	66%	30,100	3%	50,008	68%	34,032	3%	53,722	70%	37,788	4%	56,951	73%	41,362
		6	Radiant Tube Heating	4%	92,176	57%	52,183	5%	84,720	58%	49,148	5%	87,051	59%	51,719	6%	88,949	61%	54,092	6%	90,452	62%	56,272
	END USE		TECHNOLOGY																				
PROCESS HEATING	Boilers	1	Standard Efficiency Boiler	2%	34,691	49%	17,098	1%	26,388	53%	13,926	1%	22,306	56%	12,572	1%	18,561	60%	11,144	1%	15,130	64%	9,655
		2	Near Condensing Boiler	1%	17,346	56%	9,755	1%	16,126	60%	9,614	1%	16,730	63%	10,547	1%	17,236	67%	11,465	1%	17,652	70%	12,364
		3	Condensing Boiler	0%	0	0%	0	0%	1,466	67%	980	0%	2,788	70%	1,954	0%	3,977	73%	2,916	0%	5,043	77%	3,861
	Water Heaters	4	Tank-type Water Heating	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		5	Instantaneous Water Heater	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		6	Direct-fired Water Heating	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Ovens	7	Standard Efficiency Oven	4%	93,842	73%	68,693	4%	66,226	74%	49,206	3%	50,535	75%	38,103	2%	36,223	77%	27,711	2%	23,192	78%	17,997
		8	Efficient Oven	1%	17,346	84%	14,588	2%	27,746	85%	23,473	2%	38,832	85%	33,046	3%	48,764	86%	41,742	4%	57,629	86%	49,619
	Heat Treating	9	Standard Efficiency Heat Treating Furnace	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		10	Heat Treating Furnace with Sequential Firing, High-velocity Burners	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Lumber Kiln	11	Standard Efficiency Kiln	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		12	High-efficiency Kiln	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Veneer Dryers	13	Standard Efficiency Veneer Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		14	Advanced Veneer Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Paper	15	Direct-fired Paper Drying	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Pulp Lime Kilns	16	Standard Efficiency Pulp Lime Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		17	High-efficiency Pulp Lime Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Cement Kilns	18	Standard Efficiency Cement Kilns	31%	652,985	64%	418,563	31%	551,879	66%	366,172	31%	524,832	69%	360,034	31%	499,110	71%	353,619	31%	474,648	73%	346,968
		19	High-efficiency Cement Kilns	3%	69,383	82%	56,547	3%	58,640	82%	47,791	3%	55,766	82%	45,449	3%	53,033	82%	43,222	3%	50,434	82%	41,103
	Ore Drying	20	Standard Efficiency Ore Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		21	High-efficiency Ore Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Coal Drying	22	Standard Efficiency Coal Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		23	High-efficiency Coal Dryer (with centrifuge)	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Miscellaneous	24	Miscellaneous Standard Equipment	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		25	Miscellaneous Efficient Equipment	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Laundry	26	Direct-fired Gas Laundry Dryers	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Direct-fired	27	Direct-fired Heating	36%	746,869	54%	403,309	36%	631,227	56%	353,487	36%	600,291	58%	348,169	36%	570,870	60%	342,522	36%	542,892	62%	336,593
	Direct Consumption	28	Gas Consumed in Process	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Total			**100%**	**2,093,340**		**1,234,045**	**100%**	**1,769,216**		**1,081,108**	**100%**	**1,682,507**		**1,064,237**	**100%**	**1,600,047**		**1,046,262**	**100%**	**1,521,629**		**1,027,329**

Reference Case Sub sector Forecast Consumption and Market Share by Technology

ALL SERVICE AREAS

OTHER

				2010				2015				2020				2025				2030			
				Annual Sales		Annual Useful Heat		Annual Sales		Annual Useful Heat		Annual Sales		Annual Useful Heat		Annual Sales		Annual Useful Heat		Annual Sales		Annual Useful Heat	
				Market Share	Total Sales	Overall Efficiency	Total Useful Heat	Market Share	Total Sales	Overall Efficiency	Total Useful Heat	Market Share	Total Sales	Overall Efficiency	Total Useful Heat	Market Share	Total Sales	Overall Efficiency	Total Useful Heat	Market Share	Total Sales	Overall Efficiency	Total Useful Heat
	END USE		TECHNOLOGY	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)
COMFORT HEATING	Boilers	1	Standard Efficiency Boiler	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		2	Near Condensing Boilers	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		3	Condensing Boiler	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Air Heating	4	Standard Efficiency Air Handling Units and Unit Heaters	32%	351,693	52%	181,439	30%	216,890	54%	116,457	29%	195,404	56%	109,110	27%	175,504	58%	101,796	25%	157,084	60%	94,543
		5	High-efficiency Air Handling Units and Unit heaters (Condensing)	5%	50,242	64%	32,356	5%	38,323	67%	25,547	6%	41,872	69%	28,871	7%	44,982	71%	32,044	8%	47,686	74%	35,061
		6	Radiant Tube Heating	9%	100,484	57%	57,595	10%	70,938	59%	41,639	11%	72,889	60%	43,805	11%	74,478	61%	45,803	12%	75,737	63%	47,638

	END USE		TECHNOLOGY																				
PROCESS HEATING	Boilers	1	Standard Efficiency Boiler	16%	171,566	51%	87,150	14%	100,446	54%	54,558	12%	84,910	58%	49,187	11%	70,655	62%	43,549	9%	57,593	65%	37,688
		2	Near Condensing Boiler	7%	75,784	58%	43,926	8%	54,893	61%	33,679	8%	57,509	65%	37,264	9%	59,737	68%	40,792	10%	61,609	72%	44,251
		3	Condensing Boiler	5%	51,036	66%	33,437	5%	38,813	69%	26,690	6%	42,218	72%	30,402	7%	45,195	75%	34,014	8%	47,780	79%	37,511
	Water Heaters	4	Tank-type Water Heating	5%	49,820	45%	22,524	4%	30,281	46%	13,999	4%	26,762	47%	12,648	4%	23,515	48%	11,358	3%	20,522	49%	10,128
		5	Instantaneous Water Heater	2%	24,301	61%	14,756	2%	17,959	62%	11,070	3%	19,114	63%	11,958	3%	20,112	63%	12,767	3%	20,967	64%	13,503
		6	Direct-fired Water Heating	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Ovens	7	Standard Efficiency Oven	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		8	Efficient Oven	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Heat Treating	9	Standard Efficiency Heat Treating Furnace	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		10	Heat Treating Furnace with Sequential Firing, High-velocity Burners	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Lumber Kiln	11	Standard Efficiency Kiln	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		12	High-efficiency Kiln	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Veneer Dryers	13	Standard Efficiency Veneer Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		14	Advanced Veneer Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Paper	15	Direct-fired Paper Drying	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Pulp Lime Kilns	16	Standard Efficiency Pulp Lime Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		17	High-efficiency Pulp Lime Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Cement Kilns	18	Standard Efficiency Cement Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		19	High-efficiency Cement Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Ore Drying	20	Standard Efficiency Ore Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		21	High-efficiency Ore Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Coal Drying	22	Standard Efficiency Coal Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		23	High-efficiency Coal Dryer (with centrifuge)	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Miscellaneous	24	Miscellaneous Standard Equipment	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		25	Miscellaneous Efficient Equipment	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Laundry	26	Direct-fired Gas Laundry Dryers	8%	85,718	50%	42,859	8%	55,835	52%	29,090	8%	53,098	54%	28,779	8%	50,496	56%	28,429	8%	48,021	58%	28,044
	Direct-fired	27	Direct-fired Heating	4%	47,073	54%	25,419	5%	33,071	56%	18,520	5%	31,450	58%	18,241	5%	29,908	60%	17,945	5%	28,443	62%	17,634
	Direct Consumption	28	Gas Consumed in Process	9%	97,204	100%	97,204	9%	63,278	100%	63,278	9%	60,177	100%	60,177	9%	57,227	100%	57,227	9%	54,423	100%	54,423
	Total			**100%**	**1,104,921**		**638,665**	**100%**	**720,725**		**434,526**	**100%**	**685,402**		**430,441**	**100%**	**651,811**		**425,725**	**100%**	**619,865**		**420,424**

Reference Case Sub sector Forecast Consumption and Market Share by Technology

ALL SERVICE AREAS

PULP AND PAPER

				2010				2015				2020				2025				2030			
				Annual Sales		Annual Useful Heat		Annual Sales		Annual Useful Heat		Annual Sales		Annual Useful Heat		Annual Sales		Annual Useful Heat		Annual Sales		Annual Useful Heat	
				Market Share	Total Sales	Overall Efficiency	Total Useful Heat	Market Share	Total Sales	Overall Efficiency	Total Useful Heat	Market Share	Total Sales	Overall Efficiency	Total Useful Heat	Market Share	Total Sales	Overall Efficiency	Total Useful Heat	Market Share	Total Sales	Overall Efficiency	Total Useful Heat
	END USE		TECHNOLOGY	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)
COMFORT HEATING	Boilers	1	Standard Efficiency Boiler	0%	39,505	67%	26,553	0%	24,984	70%	17,584	0%	22,198	74%	16,342	0%	19,415	77%	14,936	0%	16,634	80%	13,358
		2	Near Condensing Boilers	0%	15,932	73%	11,645	0%	12,584	76%	9,549	0%	13,963	79%	10,992	0%	15,342	82%	12,517	0%	16,719	84%	14,126
		3	Condensing Boiler	0%	26	64%	17	0%	1,406	80%	1,129	0%	2,793	83%	2,310	0%	4,178	85%	3,555	0%	5,562	87%	4,862
	Air Heating	4	Standard Efficiency Air Handling Units and Unit Heaters	5%	529,543	56%	294,024	4%	353,494	58%	203,859	4%	334,869	60%	200,370	4%	316,247	62%	196,140	4%	297,628	64%	191,158
		5	High-efficiency Air Handling Units and Unit heaters (Condensing)	1%	155,541	69%	107,820	1%	118,597	72%	84,923	2%	127,896	74%	94,507	2%	137,194	76%	104,515	2%	146,491	78%	114,948
		6	Radiant Tube Heating	0%	39,113	61%	23,879	0%	36,787	62%	22,976	1%	46,083	64%	29,429	1%	55,379	65%	36,143	1%	64,674	67%	43,116

	END USE		TECHNOLOGY	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)
PROCESS HEATING	Boilers	1	Standard Efficiency Boiler	34%	3,969,284	65%	2,567,139	31%	2,510,578	69%	1,722,140	27%	2,228,438	73%	1,618,640	24%	1,947,231	77%	1,494,900	20%	1,666,894	81%	1,350,185
		2	Near Condensing Boiler	14%	1,637,585	71%	1,165,505	14%	1,191,748	75%	891,121	15%	1,231,706	78%	966,154	15%	1,271,562	82%	1,044,679	16%	1,311,323	86%	1,126,749
		3	Condensing Boiler	0%	0	0%	0	0%	40,969	79%	32,164	1%	81,781	82%	66,879	1%	122,448	85%	104,139	2%	162,981	88%	143,938
	Water Heaters	4	Tank-type Water Heating	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		5	Instantaneous Water Heater	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		6	Direct-fired Water Heating	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Ovens	7	Standard Efficiency Oven	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		8	Efficient Oven	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Heat Treating	9	Standard Efficiency Heat Treating Furnace	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		10	Heat Treating Furnace with Sequential Firing, High-velocity Burners	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Lumber Kiln	11	Standard Efficiency Kiln	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		12	High-efficiency Kiln	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Veneer Dryers	13	Standard Efficiency Veneer Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		14	Advanced Veneer Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Paper	15	Direct-fired Paper Drying	10%	1,112,902	88%	974,902	12%	979,113	88%	860,640	14%	1,174,791	88%	1,036,166	17%	1,370,063	89%	1,212,506	19%	1,564,960	89%	1,389,684
	Pulp Lime Kilns	16	Standard Efficiency Pulp Lime Kilns	27%	3,148,096	75%	2,361,072	24%	1,990,880	77%	1,524,019	22%	1,769,672	78%	1,382,113	19%	1,548,463	80%	1,233,350	16%	1,327,254	81%	1,077,730
		17	High-efficiency Pulp Lime Kilns	9%	1,049,365	91%	954,922	12%	958,572	91%	872,301	14%	1,179,781	91%	1,073,601	17%	1,400,990	91%	1,274,901	20%	1,622,199	91%	1,476,201
	Cement Kilns	18	Standard Efficiency Cement Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		19	High-efficiency Cement Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Ore Drying	20	Standard Efficiency Ore Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		21	High-efficiency Ore Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Coal Drying	22	Standard Efficiency Coal Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		23	High-efficiency Coal Dryer (with centrifuge)	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Miscellaneous	24	Miscellaneous Standard Equipment	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		25	Miscellaneous Efficient Equipment	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Laundry	26	Direct-fired Gas Laundry Dryers	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Direct-fired	27	Direct-fired Heating	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Direct Consumption	28	Gas Consumed in Process	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Total			**100%**	**11,696,893**		**8,487,479**	**100%**	**8,219,713**		**6,242,405**	**100%**	**8,213,971**		**6,497,504**	**100%**	**8,208,511**		**6,732,280**	**100%**	**8,203,319**		**6,946,056**

Reference Case Sub sector Forecast Consumption and Market Share by Technology

ALL SERVICE AREAS

WOOD PRODUCTS

COMFORT HEATING

			2010				2015				2020				2025				2030			
			Annual Sales		Annual Useful Heat		Annual Sales		Annual Useful Heat		Annual Sales		Annual Useful Heat		Annual Sales		Annual Useful Heat		Annual Sales		Annual Useful Heat	
			Market Share	Total Sales	Overall Efficiency	Total Useful Heat	Market Share	Total Sales	Overall Efficiency	Total Useful Heat	Market Share	Total Sales	Overall Efficiency	Total Useful Heat	Market Share	Total Sales	Overall Efficiency	Total Useful Heat	Market Share	Total Sales	Overall Efficiency	Total Useful Heat
END USE	TECHNOLOGY		(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)
Boilers	1	Standard Efficiency Boiler	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	2	Near Condensing Boilers	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	3	Condensing Boiler	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
Air Heating	4	Standard Efficiency Air Handling Units and Unit Heaters	3%	98,458	53%	51,960	3%	87,169	55%	47,859	3%	82,581	57%	47,116	2%	77,993	59%	46,191	2%	73,405	61%	45,082
	5	High-efficiency Air Handling Units and Unit heaters (Condensing)	0%	14,065	66%	9,266	0%	15,402	68%	10,499	1%	17,696	70%	12,467	1%	19,990	73%	14,540	1%	22,284	75%	16,719
	6	Radiant Tube Heating	1%	28,131	58%	16,442	1%	28,510	60%	17,063	1%	30,804	61%	18,867	1%	33,098	63%	20,735	1%	35,392	64%	22,668

PROCESS HEATING

END USE	TECHNOLOGY		2010 Market Share (%)	2010 Total Sales (GJ)	2010 Overall Efficiency (%)	2010 Total Useful Heat (GJ)	2015 Market Share (%)	2015 Total Sales (GJ)	2015 Overall Efficiency (%)	2015 Total Useful Heat (GJ)	2020 Market Share (%)	2020 Total Sales (GJ)	2020 Overall Efficiency (%)	2020 Total Useful Heat (GJ)	2025 Market Share (%)	2025 Total Sales (GJ)	2025 Overall Efficiency (%)	2025 Total Useful Heat (GJ)	2030 Market Share (%)	2030 Total Sales (GJ)	2030 Overall Efficiency (%)	2030 Total Useful Heat (GJ)
Boilers	1	Standard Efficiency Boiler	7%	230,913	51%	117,296	6%	193,676	54%	105,196	5%	172,157	58%	99,728	5%	150,637	62%	92,847	4%	129,117	65%	84,492
	2	Near Condensing Boiler	3%	98,963	58%	57,361	3%	102,987	61%	63,187	4%	113,746	65%	73,703	4%	124,506	68%	85,021	4%	135,266	72%	97,155
	3	Condensing Boiler	1%	32,988	66%	21,612	1%	41,502	69%	28,539	2%	52,262	72%	37,635	2%	63,022	75%	47,431	2%	73,781	79%	57,925
Water Heaters	4	Tank-type Water Heating	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	5	Instantaneous Water Heater	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	6	Direct-fired Water Heating	5%	164,938	63%	103,416	5%	153,711	66%	101,488	5%	153,711	69%	106,599	5%	153,711	73%	111,710	5%	153,711	76%	116,821
Ovens	7	Standard Efficiency Oven	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	8	Efficient Oven	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
Heat Treating	9	Standard Efficiency Heat Treating Furnace	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	10	Heat Treating Furnace with Sequential Firing, High-velocity Burners	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
Lumber Kiln	11	Standard Efficiency Kiln	60%	2,078,221	62%	1,290,575	50%	1,617,196	63%	1,025,303	40%	1,297,631	65%	839,567	31%	978,065	66%	645,523	21%	658,499	67%	443,170
	12	High-efficiency Kiln	8%	263,901	89%	233,552	18%	565,504	89%	500,471	28%	885,070	89%	783,287	38%	1,204,635	89%	1,066,102	48%	1,524,201	89%	1,348,918
Veneer Dryers	13	Standard Efficiency Veneer Dryer	10%	329,876	52%	171,866	8%	256,698	53%	135,793	6%	205,973	54%	110,608	5%	155,248	55%	84,610	3%	104,524	55%	57,802
	14	Advanced Veneer Dryer	3%	98,963	71%	70,264	4%	142,951	71%	101,496	6%	193,676	71%	137,510	8%	244,401	71%	173,525	9%	295,126	71%	209,539
Paper	15	Direct-fired Paper Drying	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
Pulp Lime Kilns	16	Standard Efficiency Pulp Lime Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	17	High-efficiency Pulp Lime Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
Cement Kilns	18	Standard Efficiency Cement Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	19	High-efficiency Cement Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
Ore Drying	20	Standard Efficiency Ore Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	21	High-efficiency Ore Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
Coal Drying	22	Standard Efficiency Coal Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	23	High-efficiency Coal Dryer (with centrifuge)	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
Miscellaneous	24	Miscellaneous Standard Equipment	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	25	Miscellaneous Efficient Equipment	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
Laundry	26	Direct-fired Gas Laundry Dryers	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
Direct-fired	27	Direct-fired Heating	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
Direct Consumption	28	Gas Consumed in Process	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
Total			**100%**	**3,439,418**		**2,143,611**	**100%**	**3,205,306**		**2,136,892**	**100%**	**3,205,306**		**2,267,086**	**100%**	**3,205,306**		**2,388,234**	**100%**	**3,205,306**		**2,500,290**

Reference Case 2010 Base Year Consumption by Service Area and Sub Sector

	LOWER MAINLAND		Agriculture		Chemical		Fabricated Metal		Food & Beverage		Mining		Miscellaneous Manufacturing		Non-Metal Manufacturing		Pulp and Paper		Wood Products		Other	
	END USE		Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)
COMFORT HEATING	Boilers	Standard Efficiency Boiler		0		0		0	2%	82,482	11%	3,245	1%	3,725		0	<0.1%	3,570		0		0
		Near Condensing Boilers		0		0		0	<0.1%	12,004	3%	811	1%	1,863		0	<0.1%	1,428		0		0
		Condensing Boiler		0		0		0	<0.1%	9,059		0	<0.1%	745		0		0		0		0
	Air Heating	Standard Efficiency Air Handling Units and Unit Heaters	14%	581,758	3%	73,832	15%	263,578	4%	156,810	16%	4,867	6%	18,625	10%	165,948	3%	48,546	1%	12,392	37%	262,559
		High-efficiency Air Handling Units and Unit heaters (Condensing)	4%	166,216		0	3%	53,640	<0.1%	15,098	8%	2,433	2%	4,843	1%	23,707	1%	14,278	<0.1%	1,770	5%	37,508
		Radiant Tube Heating	2%	83,108	<0.1%	8,204	12%	219,185	1%	26,516	16%	4,867	82%	261,316	3%	47,414	<0.1%	3,570	<0.1%	3,540	11%	75,017
PROCESS HEATING	Boilers	Standard Efficiency Boiler	14%	579,945	15%	379,382	5%	86,311	52%	1,863,859		0	1%	4,108	2%	25,624	42%	658,750	7%	57,640	16%	113,171
		Near Condensing Boiler	6%	268,243	18%	452,984	4%	64,733	11%	386,188		0	<0.1%	1,369	1%	12,812	14%	225,045	3%	24,703	7%	47,854
		Condensing Boiler	58%	2,437,789	4%	109,606		0	8%	297,296		0		0		0		0	1%	8,234	4%	27,158
	Water Heaters	Tank-type Water Heating	2%	67,061		0		0	3%	94,729		0	1%	2,739		0		0		0	4%	27,244
		Instantaneous Water Heater		0		0		0	1%	37,892		0	1%	2,739		0		0		0	2%	10,915
		Direct-fired Water Heating		0		0		0		0		0		0		0		0	5%	41,171		0
	Ovens	Standard Efficiency Oven		0		0		0	6%	221,513		0	1%	2,739	5%	84,775		0		0		0
		Efficient Oven		0		0		0	6%	202,567		0	1%	2,739	1%	12,812		0		0		0
	Heat Treating	Standard Efficiency Heat Treating Furnace		0		0	31%	560,666		0		0	1%	2,739		0		0		0		0
		Heat Treating Furnace with Sequential Firing, High-velocity Burners		0		0	20%	354,858		0		0	1%	2,739		0		0		0		0
	Lumber Kiln	Standard Efficiency Kiln		0		0		0		0		0		0		0		0	62%	518,758		0
		High-efficiency Kiln		0		0		0		0		0		0		0		0	8%	65,874		0
	Veneer Dryers	Standard Efficiency Veneer Dryer		0		0		0		0		0		0		0		0	10%	82,343		0
		Advanced Veneer Dryer		0		0		0		0		0		0		0		0	3%	24,703		0
	Paper	Direct-fired Paper Drying		0		0		0		0		0		0		0	11%	169,122		0		0
	Pulp Lime Kilns	Standard Efficiency Pulp Lime Kilns		0		0		0		0		0		0		0	21%	335,538		0		0
		High-efficiency Pulp Lime Kilns		0		0		0		0		0		0		0	7%	111,846		0		0
	Cement Kilns	Standard Efficiency Cement Kilns		0		0		0		0		0		0	34%	575,705		0		0		0
		High-efficiency Cement Kilns		0		0		0		0		0		0	3%	51,248		0		0		0
	Ore Drying	Standard Efficiency Ore Dryer		0		0		0		0		0		0		0		0		0		0
		High-efficiency Ore Dryer		0		0		0		0		0		0		0		0		0		0
	Coal Drying	Standard Efficiency Coal Dryer		0		0		0		0		0		0		0		0		0		0
		High-efficiency Coal Dryer (with centrifuge)		0		0		0		0		0		0		0		0		0		0
	Miscellaneous	Miscellaneous Standard Equipment		0		0		0		0		0	1%	2,739		0		0		0		0
		Miscellaneous Efficient Equipment		0		0		0		0		0	1%	2,739		0		0		0		0
	Laundry	Direct-fired Gas Laundry Dryers		0		0		0		0		0		0		0		0		0	6%	39,122
	Direct-fired	Direct-fired Heating		0	30%	774,123	11%	188,218	5%	189,459	46%	13,610		0	40%	676,285		0		0	2%	17,464
	Direct Consumption	Gas Consumed in Process	<0.1%	0	30%	767,240	<0.1%	0	<0.1%	0	<0.1%	0	<0.1%	0	<0.1%	0	<0.1%	0	<0.1%	0	6%	43,659
	Total		**100%**	**4,184,121**	**100%**	**2,565,371**	**100%**	**1,791,191**	**100%**	**3,595,471**	**100%**	**29,833**	**100%**	**318,506**	**100%**	**1,676,330**	**100%**	**1,571,692**	**100%**	**841,128**	**100%**	**701,672**

Reference Case 2010 Base Year Consumption by Service Area and Sub Sector

	NORTHERN INTERIOR		Agriculture		Chemical		Fabricated Metal		Food & Beverage		Mining		Miscellaneous Manufacturing		Non-Metal Manufacturing		Pulp and Paper		Wood Products		Other	
	END USE		Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)
COMFORT HEATING	Boilers	Standard Efficiency Boiler		0		0		0	5%	3,715	4%	11,131	2%	471		0	<0.1%	29,294		0		0
		Near Condensing Boilers		0		0		0	1%	557	2%	5,522	1%	236		0	<0.1%	11,806		0		0
		Condensing Boiler		0		0		0	1%	557	1%	3,652	<0.1%	94		0	<0.1%	18		0		0
	Air Heating	Standard Efficiency Air Handling Units and Unit Heaters	22%	29,339	4%	31,658	10%	34,925	13%	10,960	4%	11,828	10%	2,357	15%	20,561	5%	393,144	4%	59,708	43%	55,180
		High-efficiency Air Handling Units and Unit heaters (Condensing)	6%	8,382		0	2%	7,024	1%	929	2%	5,610	3%	613	2%	2,937	1%	115,490	<0.1%	8,530	6%	7,883
		Radiant Tube Heating	3%	4,191	8%	62,998	8%	28,287	2%	1,858	4%	11,828	79%	18,624	4%	5,875	<0.1%	29,028	1%	17,059	12%	15,766
PROCESS HEATING	Boilers	Standard Efficiency Boiler	41%	53,438	8%	62,753		0	39%	31,986	12%	32,380	1%	177	1%	890	33%	2,699,568	7%	113,445	10%	13,275
		Near Condensing Boiler	5%	7,125	22%	161,070		0	10%	8,153	11%	30,067	<0.1%	59	<0.1%	445	14%	1,153,424	3%	48,619	4%	4,978
		Condensing Boiler	20%	26,719		0		0	9%	7,526	8%	23,129		0		0		0	1%	16,206	2%	2,074
	Water Heaters	Tank-type Water Heating	1%	1,781		0		0	4%	3,136		0	<0.1%	118		0		0		0	3%	4,148
		Instantaneous Water Heater		0		0		0	2%	1,254		0	<0.1%	118		0		0		0	2%	2,074
		Direct-fired Water Heating		0		0		0		0		0		0		0		0	5%	81,032		0
	Ovens	Standard Efficiency Oven		0		0		0	6%	5,017		0	<0.1%	118	1%	890		0		0		0
		Efficient Oven		0		0		0	5%	4,390		0	<0.1%	118	<0.1%	445		0		0		0
	Heat Treating	Standard Efficiency Heat Treating Furnace		0		0	44%	159,982		0		0	<0.1%	118		0		0		0		0
		Heat Treating Furnace with Sequential Firing, High-velocity Burners		0		0	21%	74,524		0		0	<0.1%	118		0		0		0		0
	Lumber Kiln	Standard Efficiency Kiln		0		0		0		0		0		0		0		0	60%	1,021,005		0
		High-efficiency Kiln		0		0		0		0		0		0		0		0	8%	129,651		0
	Veneer Dryers	Standard Efficiency Veneer Dryer		0		0		0		0		0		0		0		0	10%	162,064		0
		Advanced Veneer Dryer		0		0		0		0		0		0		0		0	3%	48,619		0
	Paper	Direct-fired Paper Drying		0		0		0		0		0		0		0	9%	770,127		0		0
	Pulp Lime Kilns	Standard Efficiency Pulp Lime Kilns		0		0		0		0		0		0		0	28%	2,299,780		0		0
		High-efficiency Pulp Lime Kilns		0		0		0		0		0		0		0	9%	766,593		0		0
	Cement Kilns	Standard Efficiency Cement Kilns		0		0		0		0		0		0	32%	44,570		0		0		0
		High-efficiency Cement Kilns		0		0		0		0		0		0	1%	1,779		0		0		0
	Ore Drying	Standard Efficiency Ore Dryer		0		0		0		0	52%	145,710		0		0		0		0		0
		High-efficiency Ore Dryer		0		0		0		0		0		0		0		0		0		0
	Coal Drying	Standard Efficiency Coal Dryer		0		0		0		0		0		0		0		0		0		0
		High-efficiency Coal Dryer (with centrifuge)		0		0		0		0		0		0		0		0		0		0
	Miscellaneous	Miscellaneous Standard Equipment		0		0		0		0		0	<0.1%	118		0		0		0		0
		Miscellaneous Efficient Equipment		0		0		0		0		0	<0.1%	118		0		0		0		0
	Laundry	Direct-fired Gas Laundry Dryers		0		0		0		0		0		0		0		0		0	3%	3,319
	Direct-fired	Direct-fired Heating		0	27%	201,004	16%	56,370	2%	1,254		0		0	44%	62,407		0		0	9%	11,510
	Direct Consumptior	Gas Consumed in Process	<0.1%	0	30%	225,012	<0.1%	0	<0.1%	0	<0.1%	0	<0.1%	0	<0.1%	0	<0.1%	0	<0.1%	0	6%	8,297
	Total		**100%**	**130,976**	**100%**	**744,495**	**100%**	**361,111**	**100%**	**81,294**	**100%**	**280,857**	**100%**	**23,573**	**100%**	**140,798**	**100%**	**8,268,271**	**100%**	**1,705,939**	**100%**	**128,504**

Reference Case 2010 Base Year Consumption by Service Area and Sub Sector

	SOUTHER INTERIOR		Agriculture		Chemical		Fabricated Metal		Food & Beverage		Mining		Miscellaneous Manufacturing		Non-Metal Manufacturing		Pulp and Paper		Wood Products		Other	
	END USE		Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)
COMFORT HEATING	Boilers	Standard Efficiency Boiler		0		0		0	3%	16,067	2%	44,521	7%	1,838		0	<0.1%	6,433		0		0
		Near Condensing Boilers		0		0		0	1%	2,410	2%	42,001	4%	919		0	<0.1%	2,573		0		0
		Condensing Boiler		0		0		0	1%	2,410	1%	41,162	1%	368		0		0		0		0
	Air Heating	Standard Efficiency Air Handling Units and Unit Heaters	13%	21,039	29%	15,651	30%	39,282	14%	64,619	<0.1%	11,899	36%	9,189	33%	49,957	5%	87,485	4%	26,359	49%	27,565
		High-efficiency Air Handling Units and Unit heaters (Condensing)	4%	6,011		0	6%	7,856	1%	5,093	<0.1%	2,519	9%	2,389	5%	7,137	1%	25,731	1%	3,766	7%	3,938
		Radiant Tube Heating	2%	3,006	3%	1,739	24%	31,426	2%	11,263	<0.1%	11,899	14%	3,676	9%	14,274	<0.1%	6,433	1%	7,531	14%	7,876
PROCESS HEATING	Boilers	Standard Efficiency Boiler	25%	41,075	37%	20,324		0	39%	177,378	13%	364,967	4%	1,089	5%	8,177	33%	603,190	7%	50,082	9%	5,254
		Near Condensing Boiler	7%	10,953	3%	1,848		0	15%	68,344	12%	338,898	1%	363	3%	4,089	14%	257,449	3%	21,464	4%	1,970
		Condensing Boiler	49%	82,150		0		0	7%	33,152	9%	260,691		0		0		0	1%	7,155	1%	821
	Water Heaters	Tank-type Water Heating	2%	2,738		0		0	3%	13,813		0	3%	726		0		0		0	3%	1,642
		Instantaneous Water Heater		0		0		0	1%	5,525		0	3%	726		0		0		0	1%	821
		Direct-fired Water Heating		0		0		0		0		0		0		0		0	5%	35,773		0
	Ovens	Standard Efficiency Oven		0		0		0	6%	28,587		0	3%	726	5%	8,177		0		0		0
		Efficient Oven		0		0		0	5%	25,014		0	3%	726	3%	4,089		0		0		0
	Heat Treating	Standard Efficiency Heat Treating Furnace		0		0	22%	28,850		0		0	3%	726		0		0		0		0
		Heat Treating Furnace with Sequential Firing, High-velocity Burners		0		0	12%	15,736		0		0	3%	726		0		0		0		0
	Lumber Kiln	Standard Efficiency Kiln		0		0		0		0		0		0		0		0	60%	450,736		0
		High-efficiency Kiln		0		0		0		0		0		0		0		0	8%	57,236		0
	Veneer Dryers	Standard Efficiency Veneer Dryer		0		0		0		0		0		0		0		0	10%	71,545		0
		Advanced Veneer Dryer		0		0		0		0		0		0		0		0	3%	21,464		0
	Paper	Direct-fired Paper Drying		0		0		0		0		0		0		0	9%	171,986		0		0
	Pulp Lime Kilns	Standard Efficiency Pulp Lime Kilns		0		0		0		0		0		0		0	28%	512,778		0		0
		High-efficiency Pulp Lime Kilns		0		0		0		0		0		0		0	9%	170,926		0		0
	Cement Kilns	Standard Efficiency Cement Kilns		0		0		0		0		0		0	21%	32,710		0		0		0
		High-efficiency Cement Kilns		0		0		0		0		0		0	11%	16,355		0		0		0
	Ore Drying	Standard Efficiency Ore Dryer		0		0		0		0		0		0		0		0		0		0
		High-efficiency Ore Dryer		0		0		0		0		0		0		0		0		0		0
	Coal Drying	Standard Efficiency Coal Dryer		0		0		0		0	59%	1,642,354		0		0		0		0		0
		High-efficiency Coal Dryer (with centrifuge)		0		0		0		0		0		0		0		0		0		0
	Miscellaneous	Miscellaneous Standard Equipment		0		0		0		0		0	3%	726		0		0		0		0
		Miscellaneous Efficient Equipment		0		0		0		0		0	3%	726		0		0		0		0
	Laundry	Direct-fired Gas Laundry Dryers		0		0		0		0		0		0		0		0		0	2%	1,314
	Direct-fired	Direct-fired Heating		0	27%	14,781	6%	7,868	1%	5,525		0		0	5%	8,177		0		0	2%	1,314
	Direct Consumption	Gas Consumed in Process	<0.1%	0	<0.1%	0	<0.1%	0	<0.1%	0	<0.1%	0	<0.1%	0	<0.1%	0	<0.1%	0	<0.1%	0	6%	3,284
	Total		**100%**	**166,972**	**100%**	**54,342**	**100%**	**131,018**	**100%**	**459,201**	**100%**	**2,760,911**	**100%**	**25,640**	**100%**	**153,142**	**100%**	**1,844,983**	**100%**	**753,109**	**100%**	**55,797**

Reference Case 2010 Base Year Consumption by Service Area and Sub Sector

	VANCOUVER ISLAND		Agriculture		Chemical		Fabricated Metal		Food & Beverage		Mining		Miscellaneous Manufacturing		Non-Metal Manufacturing		Pulp and Paper		Wood Products		Other	
	END USE		Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)
COMFORT HEATING	Boilers	Standard Efficiency Boiler		0		0		0	1%	1,646		0	1%	125		0	2%	209		0		0
		Near Condensing Boilers		0		0		0	<0.1%	247		0	<0.1%	63		0	1%	125		0		0
		Condensing Boiler		0		0		0	<0.1%	247		0	<0.1%	25		0	<0.1%	8		0		0
	Air Heating	Standard Efficiency Air Handling Units and Unit Heaters	3%	1,133	18%	32,640	23%	3,410	3%	4,857		0	3%	626	70%	86,148	3%	368		0	3%	6,389
		High-efficiency Air Handling Units and Unit heaters (Condensing)	1%	324		0	5%	682	<0.1%	412		0	1%	163	10%	12,307	<0.1%	42		0	<0.1%	913
		Radiant Tube Heating	<0.1%	162	2%	3,627	19%	2,728	<0.1%	823		0	1%	251	20%	24,614	1%	84		0	1%	1,825
PROCESS HEATING	Boilers	Standard Efficiency Boiler	29%	11,651	12%	21,029		0	58%	95,412		0	14%	2,903		0	65%	7,777	7%	9,747	18%	39,866
		Near Condensing Boiler	8%	3,107	2%	4,206		0	17%	28,154		0	5%	968		0	14%	1,666	3%	4,177	10%	20,982
		Condensing Boiler	58%	23,303		0		0	11%	18,770		0		0		0		0	1%	1,392	10%	20,982
	Water Heaters	Tank-type Water Heating	2%	777		0		0	5%	7,821		0	9%	1,935		0		0		0	8%	16,786
		Instantaneous Water Heater		0		0		0	2%	3,128		0	9%	1,935		0		0		0	5%	10,491
		Direct-fired Water Heating		0		0		0		0		0		0		0		0	5%	6,962		0
	Ovens	Standard Efficiency Oven		0		0		0		0		0	9%	1,935		0		0		0		0
		Efficient Oven		0		0		0		0		0	9%	1,935		0		0		0		0
	Heat Treating	Standard Efficiency Heat Treating Furnace		0		0	29%	4,245		0		0	9%	1,935		0		0		0		0
		Heat Treating Furnace with Sequential Firing, High-velocity Burners		0		0	16%	2,315		0		0	9%	1,935		0		0		0		0
	Lumber Kiln	Standard Efficiency Kiln		0		0		0		0		0		0		0		0	63%	87,723		0
		High-efficiency Kiln		0		0		0		0		0		0		0		0	8%	11,139		0
	Veneer Dryers	Standard Efficiency Veneer Dryer		0		0		0		0		0		0		0		0	10%	13,924		0
		Advanced Veneer Dryer		0		0		0		0		0		0		0		0	3%	4,177		0
	Paper	Direct-fired Paper Drying		0		0		0		0		0		0		0	14%	1,666		0		0
	Pulp Lime Kilns	Standard Efficiency Pulp Lime Kilns		0		0		0		0		0		0		0		0		0		0
		High-efficiency Pulp Lime Kilns		0		0		0		0		0		0		0		0		0		0
	Cement Kilns	Standard Efficiency Cement Kilns		0		0		0		0		0		0		0		0		0		0
		High-efficiency Cement Kilns		0		0		0		0		0		0		0		0		0		0
	Ore Drying	Standard Efficiency Ore Dryer		0		0		0		0		0		0		0		0		0		0
		High-efficiency Ore Dryer		0		0		0		0		0		0		0		0		0		0
	Coal Drying	Standard Efficiency Coal Dryer		0		0		0		0		0		0		0		0		0		0
		High-efficiency Coal Dryer (with centrifuge)		0		0		0		0		0		0		0		0		0		0
	Miscellaneous	Miscellaneous Standard Equipment		0		0		0		0		0	9%	1,935		0		0		0		0
		Miscellaneous Efficient Equipment		0		0		0		0		0	9%	1,935		0		0		0		0
	Laundry	Direct-fired Gas Laundry Dryers		0		0		0		0		0		0		0		0		0	19%	41,964
	Direct-fired	Direct-fired Heating		0	65%	114,957	8%	1,158	2%	3,128		0		0		0		0		0	8%	16,786
	Direct Consumption	Gas Consumed in Process	<0.1%	0	<0.1%	0	<0.1%	0	<0.1%	0	<0.1%	0	<0.1%	0	<0.1%	0	<0.1%	0	<0.1%	0	19%	41,964
	Total		**100%**	**40,456**	**100%**	**176,459**	**100%**	**14,538**	**100%**	**164,645**	**100%**	**0**	**100%**	**20,605**	**100%**	**123,069**	**100%**	**11,946**	**100%**	**139,242**	**100%**	**218,948**

Reference Case 2010 Base Year Consumption by Service Area and Sub Sector

	TOTAL SERVICE AREAS		Agriculture		Chemical		Fabricated Metal		Food & Beverage		Mining		Miscellaneous Manufacturing		Non-Metal Manufacturing		Pulp and Paper		Wood Products		Other	
	END USE		Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)
COMFORT HEATING	Boilers	Standard Efficiency Boiler		0		0		0	2%	103,911	2%	58,897	2%	6,159		0	<0.1%	39,505		0		0
		Near Condensing Boilers		0		0		0	<0.1%	15,218	2%	48,334	1%	3,080		0	<0.1%	15,932		0		0
		Condensing Boiler		0		0		0	<0.1%	12,273	1%	44,814	<0.1%	1,232		0	<0.1%	26		0		0
	Air Heating	Standard Efficiency Air Handling Units and Unit Heaters	14%	633,268	4%	153,781	15%	341,195	6%	237,246	1%	28,594	8%	30,797	15%	322,615	5%	529,543	3%	98,458	32%	351,693
		High-efficiency Air Handling Units and Unit heaters (Condensing)	4%	180,934		0	3%	69,202	1%	21,532	<0.1%	10,562	2%	8,007	2%	46,088	1%	155,541	<0.1%	14,065	5%	50,242
		Radiant Tube Heating	2%	90,467	2%	76,567	12%	281,626	1%	40,459	1%	28,594	73%	283,867	4%	92,176	<0.1%	39,113	1%	28,131	9%	100,484
PROCESS HEATING	Boilers	Standard Efficiency Boiler	15%	686,110	14%	483,488	4%	86,311	50%	2,168,635	13%	397,348	2%	8,277	2%	34,691	34%	3,969,284	7%	230,913	16%	171,566
		Near Condensing Boiler	6%	289,429	18%	620,107	3%	64,733	11%	490,839	12%	368,966	1%	2,759	1%	17,346	14%	1,637,585	3%	98,963	7%	75,784
		Condensing Boiler	57%	2,569,961	3%	109,606		0	8%	356,743	9%	283,820		0		0		0	1%	32,988	5%	51,036
	Water Heaters	Tank-type Water Heating	2%	72,357		0		0	3%	119,499		0	1%	5,518		0		0		0	5%	49,820
		Instantaneous Water Heater		0		0		0	1%	47,800		0	1%	5,518		0		0		0	2%	24,301
		Direct-fired Water Heating		0		0		0		0		0		0		0		0	5%	164,938		0
	Ovens	Standard Efficiency Oven		0		0		0	6%	255,117		0	1%	5,518	4%	93,842		0		0		0
		Efficient Oven		0		0		0	5%	231,971		0	1%	5,518	1%	17,346		0		0		0
	Heat Treating	Standard Efficiency Heat Treating Furnace		0		0	33%	753,742		0		0	1%	5,518		0		0		0		0
		Heat Treating Furnace with Sequential Firing, High-velocity Burners		0		0	19%	447,434		0		0	1%	5,518		0		0		0		0
	Lumber Kiln	Standard Efficiency Kiln		0		0		0		0		0		0		0		0	60%	2,078,221		0
		High-efficiency Kiln		0		0		0		0		0		0		0		0	8%	263,901		0
	Veneer Dryers	Standard Efficiency Veneer Dryer		0		0		0		0		0		0		0		0	10%	329,876		0
		Advanced Veneer Dryer		0		0		0		0		0		0		0		0	3%	98,963		0
	Paper	Direct-fired Paper Drying		0		0		0		0		0		0		0	10%	1,112,902		0		0
	Pulp Lime Kilns	Standard Efficiency Pulp Lime Kilns		0		0		0		0		0		0		0	27%	3,148,096		0		0
		High-efficiency Pulp Lime Kilns		0		0		0		0		0		0		0	9%	1,049,365		0		0
	Cement Kilns	Standard Efficiency Cement Kilns		0		0		0		0		0		0	31%	652,985		0		0		0
		High-efficiency Cement Kilns		0		0		0		0		0		0	3%	69,383		0		0		0
	Ore Drying	Standard Efficiency Ore Dryer		0		0		0		0	5%	145,710		0		0		0		0		0
		High-efficiency Ore Dryer		0		0		0		0		0		0		0		0		0		0
	Coal Drying	Standard Efficiency Coal Dryer		0		0		0		0	53%	1,642,354		0		0		0		0		0
		High-efficiency Coal Dryer (with centrifuge)		0		0		0		0		0		0		0		0		0		0
	Miscellaneous	Miscellaneous Standard Equipment		0		0		0		0		0	1%	5,518		0		0		0		0
		Miscellaneous Efficient Equipment		0		0		0		0		0	1%	5,518		0		0		0		0
	Laundry	Direct-fired Gas Laundry Dryers		0		0		0		0		0		0		0		0		0	8%	85,718
	Direct-fired	Direct-fired Heating		0	31%	1,104,865	11%	253,613	5%	199,366	<0.1%	13,610		0	36%	746,869		0		0	4%	47,073
	Direct Consumption	Gas Consumed in Process	<0.1%	0	28%	992,252	<0.1%	0	<0.1%	0	<0.1%	0	<0.1%	0	<0.1%	0	<0.1%	0	<0.1%	0	9%	97,204
	Total		**100%**	**4,522,525**	**100%**	**3,540,666**	**100%**	**2,297,858**	**100%**	**4,300,611**	**100%**	**3,071,601**	**100%**	**388,324**	**100%**	**2,093,340**	**100%**	**11,696,893**	**100%**	**3,439,418**	**100%**	**1,104,921**

Appendix C Background-Chapter 5: Technology Assessments

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.045	$0.0121
Natural Gas	$0.016	$0.0103
Discount Rate	6.87%	

Financial & Economic Analysis - Energy-efficiency Measures

Direct-fired and Radiant Tube Heating (Variable Load)

	Measure Description	Baseline Energy Use (MJ/yr.) Natural Gas	Baseline Energy Use (MJ/yr.) Electricity	Upgrade Energy Use (MJ/yr.) Natural Gas	Upgrade Energy Use (MJ/yr.) Electricity	Measure Capital & Installation Cost F = full I=Incremental		Incremental O & M ($/yr)	Measure Life (yrs.)	Annual Energy Svg (MJ/yr.) Natural Gas	Annual Energy Svg (MJ/yr.) Electricity	Participant Impact: Annual Energy Svgs (MJ)	Participant Impact: Annual Cost Svgs ($)	Participant Impact: Simple Payback (yrs.)	Measure Total Resource Cost	B/C Ratio
1	Switch 3.3 MBTU Unit Heater to Direct-fired Heat Baseline Nat Gas Efficiency = 80% Upgrade Efficiency = 90%	10,440,000	-	9,280,000	0	F	$54,000	$0	20	1,160,000	0	1,160,000	$11,984.68	4.5	$140,158	3.6
2	Switch 3.3 MBTU Unit Heater to Direct-fired Heat Baseline Nat Gas Efficiency = 80% Upgrade Efficiency = 90%	10,440,000	-	9,825,882	0	I	$19,034	$0	20	614,118	0	614,118	$6,344.83	3.0	$83,755	5.4

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.045	$0.0121
Natural Gas	$0.016	$0.0064
Discount Rate	7.38%	

Financial & Economic Analysis - Energy-efficiency Measures

Measure Name: Direct-fired and Radiant Tube Heating (Variable Load)

	Measure Description	Baseline Energy Use (MJ/yr.) Natural Gas	Baseline Energy Use (MJ/yr.) Electricity	Upgrade Energy Use (MJ/yr.) Natural Gas	Upgrade Energy Use (MJ/yr.) Electricity	Measure Capital & Installation Cost F = full I=Incremental		Incremental O & M ($/yr)	Measure Life (yrs.)	Annual Energy Svg (MJ/yr.) Natural Gas	Annual Energy Svg (MJ/yr.) Electricity	Participant Impact: Annual Energy Svgs (MJ)	Participant Impact: Annual Cost Svgs ($)	Participant Impact: Simple Payback (yrs.)	Measure Total Resource Cost	B/C Ratio
1	Switch 3.3 MBTU Unit Heater to Direct-fired Heat Baseline Nat Gas Efficiency = 80% Upgrade Efficiency = 90%	10,440,000	-	9,280,000	0	F	$54,000	$0	20	1,160,000	0	1,160,000	$7,370.63	7.3	$132,653	3.5
2	Switch 3.3 MBTU Unit Heater to Direct-fired Heat Baseline Nat Gas Efficiency = 80% Upgrade Efficiency = 90%	10,440,000	-	9,825,882	0	I	$11,706	$0	20	614,118	0	614,118	$3,902.10	3.0	$87,110	8.4

Northern Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.045	$0.0121
Natural Gas	$0.016	$0.0064
Discount Rate	7.38%	

Financial & Economic Analysis - Energy-efficiency Measures

Measure Name: Direct-fired and Radiant Tube Heating (Variable Load)

	Measure Description	Baseline Energy Use (MJ/yr.) Natural Gas	Baseline Energy Use (MJ/yr.) Electricity	Upgrade Energy Use (MJ/yr.) Natural Gas	Upgrade Energy Use (MJ/yr.) Electricity	Measure Capital & Installation Cost F = full I=Incremental		Incremental O & M ($/yr)	Measure Life (yrs.)	Annual Energy Svg (MJ/yr.) Natural Gas	Annual Energy Svg (MJ/yr.) Electricity	Participant Impact: Annual Energy Svgs (MJ)	Participant Impact: Annual Cost Svgs ($)	Participant Impact: Simple Payback (yrs.)	Measure Total Resource Cost	B/C Ratio
1	Switch 3.3 MBTU Unit Heater to Direct-fired Heat Baseline Nat Gas Efficiency = 80% Upgrade Efficiency = 90%	17,400,000	-	15,466,667	0	F	$54,000	$0	20	1,933,333	0	1,933,333	$12,284.38	4.4	$257,088	5.8
2	Switch 3.3 MBTU Unit Heater to Direct-fired Heat Baseline Nat Gas Efficiency = 80% Upgrade Efficiency = 90%	17,400,000	-	16,376,471	0	I	$19,510	$0	20	1,023,529	0	1,023,529	$6,503.50	3.0	$145,183	8.4

Southern Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.045	$0.0121
Natural Gas	$0.016	$0.0064
Discount Rate	7.38%	

Financial & Economic Analysis - Energy-efficiency Measures

Measure Name: Direct-fired and Radiant Tube Heating (Variable Load)

	Measure Description	Baseline Energy Use (MJ/yr.) Natural Gas	Baseline Energy Use (MJ/yr.) Electricity	Upgrade Energy Use (MJ/yr.) Natural Gas	Upgrade Energy Use (MJ/yr.) Electricity	Measure Capital & Installation Cost F = full I=Incremental		Incremental O & M ($/yr)	Measure Life (yrs.)	Annual Energy Svg (MJ/yr.) Natural Gas	Annual Energy Svg (MJ/yr.) Electricity	Participant Impact: Annual Energy Svgs (MJ)	Participant Impact: Annual Cost Svgs ($)	Participant Impact: Simple Payback (yrs.)	Measure Total Resource Cost	B/C Ratio
1	Switch 3.3 MBTU Unit Heater to Direct-fired Heat Baseline Nat Gas Efficiency = 80% Upgrade Efficiency = 90%	13,920,000	-	12,373,333	0	F	$54,000	$0	20	1,546,667	0	1,546,667	$9,827.50	5.5	$194,870	4.6
2	Switch 3.3 MBTU Unit Heater to Direct-fired Heat Baseline Nat Gas Efficiency = 80% Upgrade Efficiency = 90%	13,920,000	-	13,101,176	0	I	$15,608	$0	20	818,824	0	818,824	$5,202.80	3.0	$116,146	8.4

** *Measure TRC = Measure cost + chg in annual O&M +PV Electricity Avoided Cost/Supply + PV Natural Gas Avoided Cost/Supply*

** *Considerations such as incentives, program delivery costs occur in later stages of the analysis*

** *1KWh = 3.6 MJ*

Assumptions:

Price and payback are from suppliers and literature as cited in the the Industrial Sector Report

Price of Direct-fired Heating per RS Means

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.045	$0.0121
Natural Gas	$0.016	$0.0103
Discount Rate	6.87%	

Financial & Economic Analysis - Energy-efficiency Measures

Efficient Boilers for Constant Annual Loads

Measure Description	Baseline Energy Use (MJ/yr.)		Upgrade Energy Use (MJ/yr.)		Measure Capital & Installation Cost F = full I=Incremental		Incremental O & M ($/yr)	Measure Life (yrs.)	Annual Energy Svg (MJ/yr.)		Participant Impact			Measure Total Resource Cost	B/C Ratio
	Natural Gas	Electricity	Natural Gas	Electricity					Natural Gas	Electricity	Annual Energy Svgs (MJ)	Annual Cost Svgs ($)	Simple Payback (yrs.)		
2200 MBTU Output Near Condensing Boiler Standard Boiler Seasonal Efficiency = 68% New Boiler Seasonal Efficiency = 80%	9,748,200	-	8,285,970	0	F	$56,827	$0	25	1,462,230	0	1,462,230	$15,107.22	3.8	$212,832	4.7
2200 MBTU Output Near Condensing Boiler Standard Boiler Seasonal Efficiency = 68% New Boiler Seasonal Efficiency = 80%	9,748,200	-	8,285,970	0	I	$16,402	$0	25	1,462,230	0	1,462,230	$15,107.22	1.1	$253,257	16.4
2200 MBTU Output Condensing Boiler Standard Boiler Seasonal Efficiency = 68% New Boiler Seasonal Efficiency = 92%	9,748,200	-	7,205,191	0	F	$89,473	$1,600	25	2,543,009	0	2,543,009	$24,673.42	3.6	$360,633	4.3
2200 MBTU Output Condensing Boiler Standard Boiler Seasonal Efficiency = 68% New Boiler Seasonal Efficiency = 92%	9,748,200	-	7,205,191	0	I	$49,048	$1,600	25	2,543,009	0	2,543,009	$24,673.42	2.0	$401,058	6.9
2200 MBTU Output Condensing Boiler Near Condensing Boiler Seasonal Efficiency = 80% New Boiler Seasonal Efficiency = 92%	8,285,970	-	7,205,191	0	F	$89,473	$1,600	25	1,080,779	0	1,080,779	$9,566.21	9.4	$90,974	1.8
2200 MBTU Output Condensing Boiler Near Condensing Boiler Seasonal Efficiency = 80% New Boiler Seasonal Efficiency = 92%	8,285,970	-	7,205,191	0	I	$49,048	$1,600	25	1,080,779	0	1,080,779	$9,566.21	5.1	$131,399	2.9

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.045	$0.0121
Natural Gas	$0.016	$0.0064
Discount Rate	7.38%	

Financial & Economic Analysis - Energy-efficiency Measures

Measure Name: Efficient Boilers for Constant Annual Loads

Measure Description	Baseline Energy Use (MJ/yr.)		Upgrade Energy Use (MJ/yr.)		Measure Capital & Installation Cost F = full I=Incremental		Incremental O & M ($/yr)	Measure Life (yrs.)	Annual Energy Svg (MJ/yr.)		Participant Impact			Measure Total Resource Cost	B/C Ratio
	Natural Gas	Electricity	Natural Gas	Electricity					Natural Gas	Electricity	Annual Energy Svgs (MJ)	Annual Cost Svgs ($)	Simple Payback (yrs.)		
2200 MBTU Output Near Condensing Boiler Standard Boiler Seasonal Efficiency = 68% New Boiler Seasonal Efficiency = 80%	9,748,200	-	8,285,970	0	F	$56,827	$0	25	1,462,230	0	1,462,230	$9,291.01	6.1	$200,801.39	4.5
2200 MBTU Output Near Condensing Boiler Standard Boiler Seasonal Efficiency = 68% New Boiler Seasonal Efficiency = 80%	9,748,200	-	8,285,970	0	I	$16,402	$0	25	1,462,230	0	1,462,230	$9,291.01	1.8	$241,226	15.7
2200 MBTU Output Condensing Boiler Standard Boiler Seasonal Efficiency = 68% New Boiler Seasonal Efficiency = 92%	9,748,200	-	7,205,191	0	F	$89,473	$1,600	25	2,543,009	0	2,543,009	$14,558.26	6.1	$340,552	4.2
2200 MBTU Output Condensing Boiler Standard Boiler Seasonal Efficiency = 68% New Boiler Seasonal Efficiency = 92%	9,748,200	-	7,205,191	0	I	$49,048	$1,600	25	2,543,009	0	2,543,009	$14,558.26	3.4	$380,977	6.7
2200 MBTU Output Condensing Boiler Near Condensing Boiler Seasonal Efficiency = 80% New Boiler Seasonal Efficiency = 92%	8,285,970	-	7,205,191	0	F	$89,473	$1,600	25	1,080,779	0	1,080,779	$5,267.27	17.0	$82,923	1.8
2200 MBTU Output Condensing Boiler Near Condensing Boiler Seasonal Efficiency = 80% New Boiler Seasonal Efficiency = 92%	8,285,970	-	7,205,191	0	I	$49,048	$1,600	25	1,080,779	0	1,080,779	$5,267.27	9.3	$123,348	2.8

Northern Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.045	$0.0121
Natural Gas	$0.016	$0.0064
Discount Rate	7.38%	

Financial & Economic Analysis - Energy-efficiency Measures

Measure Name: Efficient Boilers for Constant Annual Loads

Measure Description	Baseline Energy Use (MJ/yr.)		Upgrade Energy Use (MJ/yr.)		Measure Capital & Installation Cost F = full I=Incremental		Incremental O & M ($/yr)	Measure Life (yrs.)	Annual Energy Svg (MJ/yr.)		Participant Impact			Measure Total Resource Cost	B/C Ratio
	Natural Gas	Electricity	Natural Gas	Electricity					Natural Gas	Electricity	Annual Energy Svgs (MJ)	Annual Cost Svgs ($)	Simple Payback (yrs.)		
2200 MBTU Output Near Condensing Boiler Standard Boiler Seasonal Efficiency = 68% New Boiler Seasonal Efficiency = 80%	9,748,200	-	8,285,970	0	F	$56,827	$0	25	1,462,230	0	1,462,230	$9,291.01	6.1	$200,801	4.5
2200 MBTU Output Near Condensing Boiler Standard Boiler Seasonal Efficiency = 68% New Boiler Seasonal Efficiency = 80%	9,748,200	-	8,285,970	0	I	$16,402	$0	25	1,462,230	0	1,462,230	$9,291.01	1.8	$241,226	15.7
2200 MBTU Output Condensing Boiler Standard Boiler Seasonal Efficiency = 68% New Boiler Seasonal Efficiency = 92%	9,748,200	-	7,205,191	0	F	$89,473	$1,600	25	2,543,009	0	2,543,009	$14,558.26	6.1	$340,552	4.2
2200 MBTU Output Condensing Boiler Standard Boiler Seasonal Efficiency = 68% New Boiler Seasonal Efficiency = 92%	9,748,200	-	7,205,191	0	I	$49,048	$1,600	25	2,543,009	0	2,543,009	$14,558.26	3.4	$380,977	6.7
2200 MBTU Output Condensing Boiler Near Condensing Boiler Seasonal Efficiency = 80% New Boiler Seasonal Efficiency = 92%	8,285,970	-	7,205,191	0	F	$89,473	$1,600	25	1,080,779	0	1,080,779	$5,267.27	17.0	$82,923	1.8
2200 MBTU Output Condensing Boiler Near Condensing Boiler Seasonal Efficiency = 80% New Boiler Seasonal Efficiency = 92%	8,285,970	-	7,205,191	0	I	$49,048	$1,600	25	1,080,779	0	1,080,779	$5,267.27	9.3	$123,348	2.8

Southern Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.045	$0.0121
Natural Gas	$0.016	$0.0064
Discount Rate	7.38%	

Financial & Economic Analysis - Energy-efficiency Measures

Measure Name: Efficient Boilers for Constant Annual Loads

Measure Description	Baseline Energy Use (MJ/yr.)		Upgrade Energy Use (MJ/yr.)		Measure Capital & Installation Cost F = full I=Incremental		Incremental O & M ($/yr)	Measure Life (yrs.)	Annual Energy Svg (MJ/yr.)		Participant Impact			Measure Total Resource Cost	B/C Ratio
	Natural Gas	Electricity	Natural Gas	Electricity					Natural Gas	Electricity	Annual Energy Svgs (MJ)	Annual Cost Svgs ($)	Simple Payback (yrs.)		
2200 MBTU Output Near Condensing Boiler Standard Boiler Seasonal Efficiency = 68% New Boiler Seasonal Efficiency = 80%	9,748,200	-	8,285,970	0	F	$56,827	$0	25	1,462,230	0	1,462,230	$9,291.01	6.1	$200,801	4.5
2200 MBTU Output Near Condensing Boiler Standard Boiler Seasonal Efficiency = 68% New Boiler Seasonal Efficiency = 80%	9,748,200	-	8,285,970	0	I	$16,402	$0	25	1,462,230	0	1,462,230	$9,291.01	1.8	$241,226	15.7
2200 MBTU Output Condensing Boiler Standard Boiler Seasonal Efficiency = 68% New Boiler Seasonal Efficiency = 92%	9,748,200	-	7,205,191	0	F	$89,473	$1,600	25	2,543,009	0	2,543,009	$14,558.26	6.1	$340,552	4.2
2200 MBTU Output Condensing Boiler Standard Boiler Seasonal Efficiency = 68% New Boiler Seasonal Efficiency = 92%	9,748,200	-	7,205,191	0	I	$49,048	$1,600	25	2,543,009	0	2,543,009	$14,558.26	3.4	$380,977	6.7
2200 MBTU Output Condensing Boiler Near Condensing Boiler Seasonal Efficiency = 80% New Boiler Seasonal Efficiency = 92%	8,285,970	-	7,205,191	0	F	$89,473	$1,600	25	1,080,779	0	1,080,779	$5,267.27	17.0	$82,923	1.8
2200 MBTU Output Condensing Boiler Near Condensing Boiler Seasonal Efficiency = 80% New Boiler Seasonal Efficiency = 92%	8,285,970	-	7,205,191	0	I	$49,048	$1,600	25	1,080,779	0	1,080,779	$5,267.27	9.3	$123,348	2.8

** *Measure TRC = Measure cost + chg in annual O&M +PV Electricity Avoided Cost/Supply + PV Natural Gas Avoided Cost/Supply*

** *Considerations such as incentives, program delivery costs occur in later stages of the analysis*

** *1KWh = 3.6 MJ*

Assumptions:

Standard boiler input of 3.3 MBTU (1MW)and 70% loaded annual operating hours of 4,000 per year based on average annual process heat purchase of accounts in manufacturing sector.

Installed cost of near condensing and condensing boilers is from Viessmann

Purchase cost of standard boilers is $7/kBTU Input as per FortisBC Efficient Boiler Program definition

Electricity use and savings are negligible for boilers

Incremental maintenance for condensing boilers is assumed to be 2 days annually.

Boiler efficiency as per FortisBC Efficient Boiler Program

1 MBTU	1.055	MJ
	3300	MBTU input Boiler (Standard Efficiency)
	68%	Efficienct - Condensing Boiler
	80%	Efficient - near condensing
	92%	Efficient - Condensing
	4000	average operating hours
	70%	average load
	2244	Output boiler

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.045	$0.0121
Natural Gas	$0.016	$0.0103
Discount Rate	6.87%	

Financial & Economic Analysis - Energy-efficiency Measures

Large Boiler Replacement

Measure Description	Baseline Energy Use (MJ/yr.)		Upgrade Energy Use (MJ/yr.)		Measure Capital & Installation Cost F = full I=Incremental		Incremental O & M ($/yr)	Measure Life (yrs.)	Annual Energy Svg (MJ/yr.)		Participant Impact			Measure Total Resource Cost	B/C Ratio
	Natural Gas	Electricity	Natural Gas	Electricity					Natural Gas	Electricity	Annual Energy Svgs (MJ)	Annual Cost Svgs ($)	Simple Payback (yrs.)		
Replace Existing 50,000 lb/hr Gas-fired Boiler with more efficient one inculding condensing heat exchanger	637,390,680	-	564,959,921	0	F	$2,500,000	$0	25	72,430,759	0	72,430,759	$748,327.30	3.3	$10,857,432	5.3

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.045	$0.0121
Natural Gas	$0.016	$0.0064
Discount Rate	7.38%	

Financial & Economic Analysis - Energy-efficiency Measures

Large Boiler Replacement

Measure Description	Baseline Energy Use (MJ/yr.)		Upgrade Energy Use (MJ/yr.)		Measure Capital & Installation Cost F = full I=Incremental		Incremental O & M ($/yr)	Measure Life (yrs.)	Annual Energy Svg (MJ/yr.)		Participant Impact			Measure Total Resource Cost	B/C Ratio
	Natural Gas	Electricity	Natural Gas	Electricity					Natural Gas	Electricity	Annual Energy Svgs (MJ)	Annual Cost Svgs ($)	Simple Payback (yrs.)		
Replace Two 50,000 lb/hr Gas-fired Boiler with more efficient units inculding condensing heat exchanger	1,274,781,361	-	1,129,919,843	0	F	$5,000,000	$0	25	144,861,518	0	144,861,518	$920,448.60	5.4	$20,523,004	5.1

Northern Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.045	$0.0121
Natural Gas	$0.016	$0.0064
Discount Rate	7.38%	

Financial & Economic Analysis - Energy-efficiency Measures

Large Boiler Replacement

Measure Description	Baseline Energy Use (MJ/yr.)		Upgrade Energy Use (MJ/yr.)		Measure Capital & Installation Cost F = full I=Incremental		Incremental O & M ($/yr)	Measure Life (yrs.)	Annual Energy Svg (MJ/yr.)		Participant Impact			Measure Total Resource Cost	B/C Ratio
	Natural Gas	Electricity	Natural Gas	Electricity					Natural Gas	Electricity	Annual Energy Svgs (MJ)	Annual Cost Svgs ($)	Simple Payback (yrs.)		
Replace two 750,000 lb/hr steam existing grate wood waste/gas boilers with fluidized bed unit	4,408,511,088	-	413,297,914	0	F	$180,000,000	$9,791,981	25	3,995,213,173	0	3,995,213,173	$15,593,562.04	11.5	$413,603,144	2.4

Southern Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.045	$0.0121
Natural Gas	$0.016	$0.0064
Discount Rate	7.38%	

Financial & Economic Analysis - Energy-efficiency Measures

Large Boiler Replacement

Measure Description	Baseline Energy Use (MJ/yr.)		Upgrade Energy Use (MJ/yr.)		Measure Capital & Installation Cost F = full I=Incremental		Incremental O & M ($/yr)	Measure Life (yrs.)	Annual Energy Svg (MJ/yr.)		Participant Impact			Measure Total Resource Cost	B/C Ratio
	Natural Gas	Electricity	Natural Gas	Electricity					Natural Gas	Electricity	Annual Energy Svgs (MJ)	Annual Cost Svgs ($)	Simple Payback (yrs.)		
Replace Existing 50,000 lb/hr Gas-fired Boiler with more efficient one inculding condensing heat exchanger	637,390,680	-	564,959,921	0	F	$2,500,000	$0	25	72,430,759	0	72,430,759	$460,224.30	5.4	$10,261,502	5.1

** *Measure TRC = Measure cost + chg in annual O&M +PV Electricity Avoided Cost/Supply + PV Natural Gas Avoided Cost/Supply*

** *Considerations such as incentives, program delivery costs occur in later stages of the analysis*

** *1KWh = 3.6 MJ*

Assumptions:

1/ Assume two 750,000 lb/hr boiler replacements in the Northern Interior

2/ Assume two 50,000 lb/hr boiler replacements in Lower Mainland

3/ Assume one 50,000 lb/hr boiler replacement in Southern Interior and another one on Vancouver Island

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.045	$0.0121
Natural Gas	$0.016	$0.0103
Discount Rate	6.87%	

Financial & Economic Analysis - Energy-efficiency Measures

Efficient Boilers for Variable Annual Loads

Measure Description	Baseline Energy Use (MJ/yr.)		Upgrade Energy Use (MJ/yr.)		Measure Capital & Installation Cost F = full I=Incremental		Incremental O & M ($/yr)	Measure Life (yrs.)	Annual Energy Svg (MJ/yr.)		Participant Impact			Measure Total Resource Cost	B/C Ratio
	Natural Gas	Electricity	Natural Gas	Electricity					Natural Gas	Electricity	Annual Energy Svgs (MJ)	Annual Cost Svgs ($)	Simple Payback (yrs.)		
2200 MBTU Output Near Condensing Boiler Standard Boiler Seasonal Efficiency = 68% New Boiler Seasonal Efficiency = 80%	4,177,800	-	3,551,130	0	F	$56,827	$0	25	626,670	0	626,670	$6,474.53	8.8	$58,741	2.0
2200 MBTU Output Near Condensing Boiler Standard Boiler Seasonal Efficiency = 68% New Boiler Seasonal Efficiency = 80%	4,177,800	-	3,551,130	0	I	$16,402	$0	25	626,670	0	626,670	$6,474.53	2.5	$99,166	7.0
2200 MBTU Output Condensing Boiler Standard Boiler Seasonal Efficiency = 68% New Boiler Seasonal Efficiency = 92%	4,177,800	-	3,087,939	0	F	$89,473	$1,600	25	1,089,861	0	1,089,861	$9,660.04	9.3	$92,649	1.9
2200 MBTU Output Condensing Boiler Standard Boiler Seasonal Efficiency = 68% New Boiler Seasonal Efficiency = 92%	4,177,800	-	3,087,939	0	I	$49,048	$1,600	25	1,089,861	0	1,089,861	$9,660.04	5.1	$133,074	3.0
2200 MBTU Output Condensing Boiler Near Condensing Boiler Seasonal Efficiency = 80% New Boiler Seasonal Efficiency = 92%	3,551,130	-	3,087,939	0	F	$89,473	$1,600	25	463,191	0	463,191	$3,185.53	28.1	-$22,919	0.8
2200 MBTU Output Condensing Boiler Near Condensing Boiler Seasonal Efficiency = 80% New Boiler Seasonal Efficiency = 92%	3,551,130	-	3,087,939	0	I	$49,048	$1,600	25	463,191	0	463,191	$3,185.53	15.4	$17,506	1.3

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.045	$0.0121
Natural Gas	$0.016	$0.0064
Discount Rate	7.38%	

Financial & Economic Analysis - Energy-efficiency Measures

Measure Name: Efficient Boilers for Variable Annual Loads

Measure Description	Baseline Energy Use (MJ/yr.)		Upgrade Energy Use (MJ/yr.)		Measure Capital & Installation Cost F = full I=Incremental		Incremental O & M ($/yr)	Measure Life (yrs.)	Annual Energy Svg (MJ/yr.)		Participant Impact			Measure Total Resource Cost	B/C Ratio
	Natural Gas	Electricity	Natural Gas	Electricity					Natural Gas	Electricity	Annual Energy Svgs (MJ)	Annual Cost Svgs ($)	Simple Payback (yrs.)		
2200 MBTU Output Near Condensing Boiler Standard Boiler Seasonal Efficiency = 68% New Boiler Seasonal Efficiency = 80%	4,177,800	-	3,551,130	0	F	$56,827	$0	25	626,670	0	626,670	$3,981.87	14.3	$53,584.92	1.9
2200 MBTU Output Near Condensing Boiler Standard Boiler Seasonal Efficiency = 68% New Boiler Seasonal Efficiency = 80%	4,177,800	-	3,551,130	0	I	$16,402	$0	25	626,670	0	626,670	$3,981.87	4.1	$94,010	6.7
2200 MBTU Output Condensing Boiler Standard Boiler Seasonal Efficiency = 68% New Boiler Seasonal Efficiency = 92%	4,177,800	-	3,087,939	0	F	$89,473	$1,600	25	1,089,861	0	1,089,861	$5,324.98	16.8	$84,524	1.8
2200 MBTU Output Condensing Boiler Standard Boiler Seasonal Efficiency = 68% New Boiler Seasonal Efficiency = 92%	4,177,800	-	3,087,939	0	I	$49,048	$1,600	25	1,089,861	0	1,089,861	$5,324.98	9.2	$124,949	2.9
2200 MBTU Output Condensing Boiler Near Condensing Boiler Seasonal Efficiency = 80% New Boiler Seasonal Efficiency = 92%	3,551,130	-	3,087,939	0	F	$89,473	$1,600	25	463,191	0	463,191	$1,343.12	66.6	-$25,889	0.8
2200 MBTU Output Condensing Boiler Near Condensing Boiler Seasonal Efficiency = 80% New Boiler Seasonal Efficiency = 92%	3,551,130	-	3,087,939	0	I	$49,048	$1,600	25	463,191	0	463,191	$1,343.12	36.5	$14,536	1.2

Northern Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.045	$0.0121
Natural Gas	$0.016	$0.0064
Discount Rate	7.38%	

Financial & Economic Analysis - Energy-efficiency Measures

Measure Name: Efficient Boilers for Variable Annual Loads

Measure Description	Baseline Energy Use (MJ/yr.)		Upgrade Energy Use (MJ/yr.)		Measure Capital & Installation Cost F = full I=Incremental		Incremental O & M ($/yr)	Measure Life (yrs.)	Annual Energy Svg (MJ/yr.)		Participant Impact			Measure Total Resource Cost	B/C Ratio
	Natural Gas	Electricity	Natural Gas	Electricity					Natural Gas	Electricity	Annual Energy Svgs (MJ)	Annual Cost Svgs ($)	Simple Payback (yrs.)		
2200 MBTU Output Near Condensing Boiler Standard Boiler Seasonal Efficiency = 68% New Boiler Seasonal Efficiency = 80%	4,177,800	-	3,551,130	0	F	$56,827	$0	25	626,670	0	626,670	$3,981.87	14.3	$53,585	1.9
2200 MBTU Output Near Condensing Boiler Standard Boiler Seasonal Efficiency = 68% New Boiler Seasonal Efficiency = 80%	4,177,800	-	3,551,130	0	I	$16,402	$0	25	626,670	0	626,670	$3,981.87	4.1	$94,010	6.7
2200 MBTU Output Condensing Boiler Standard Boiler Seasonal Efficiency = 68% New Boiler Seasonal Efficiency = 92%	4,177,800	-	3,087,939	0	F	$89,473	$1,600	25	1,089,861	0	1,089,861	$5,324.98	16.8	$84,524	1.8
2200 MBTU Output Condensing Boiler Standard Boiler Seasonal Efficiency = 68% New Boiler Seasonal Efficiency = 92%	4,177,800	-	3,087,939	0	I	$49,048	$1,600	25	1,089,861	0	1,089,861	$5,324.98	9.2	$124,949	2.9
2200 MBTU Output Condensing Boiler Near Condensing Boiler Seasonal Efficiency = 80% New Boiler Seasonal Efficiency = 92%	3,551,130	-	3,087,939	0	F	$89,473	$1,600	25	463,191	0	463,191	$1,343.12	66.6	-$25,889	0.8
2200 MBTU Output Condensing Boiler Near Condensing Boiler Seasonal Efficiency = 80% New Boiler Seasonal Efficiency = 92%	3,551,130	-	3,087,939	0	I	$49,048	$1,600	25	463,191	0	463,191	$1,343.12	36.5	$14,536	1.2

Southern Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.045	$0.0121
Natural Gas	$0.016	$0.0064
Discount Rate	7.38%	

Financial & Economic Analysis - Energy-efficiency Measures

Measure Name: Efficient Boilers for Variable Annual Loads

Measure Description	Baseline Energy Use (MJ/yr.)		Upgrade Energy Use (MJ/yr.)		Measure Capital & Installation Cost F = full I=Incremental		Incremental O & M ($/yr)	Measure Life (yrs.)	Annual Energy Svg (MJ/yr.)		Participant Impact			Measure Total Resource Cost	B/C Ratio
	Natural Gas	Electricity	Natural Gas	Electricity					Natural Gas	Electricity	Annual Energy Svgs (MJ)	Annual Cost Svgs ($)	Simple Payback (yrs.)		
2200 MBTU Output Near Condensing Boiler Standard Boiler Seasonal Efficiency = 68% New Boiler Seasonal Efficiency = 80%	4,177,800	-	3,551,130	0	F	$56,827	$0	25	626,670	0	626,670	$3,981.87	14.3	$53,585	1.9
2200 MBTU Output Near Condensing Boiler Standard Boiler Seasonal Efficiency = 68% New Boiler Seasonal Efficiency = 80%	4,177,800	-	3,551,130	0	I	$16,402	$0	25	626,670	0	626,670	$3,981.87	4.1	$94,010	6.7
2200 MBTU Output Condensing Boiler Standard Boiler Seasonal Efficiency = 68% New Boiler Seasonal Efficiency = 92%	4,177,800	-	3,087,939	0	F	$89,473	$1,600	25	1,089,861	0	1,089,861	$5,324.98	16.8	$84,524	1.8
2200 MBTU Output Condensing Boiler Standard Boiler Seasonal Efficiency = 68% New Boiler Seasonal Efficiency = 92%	4,177,800	-	3,087,939	0	I	$49,048	$1,600	25	1,089,861	0	1,089,861	$5,324.98	9.2	$124,949	2.9
2200 MBTU Output Condensing Boiler Near Condensing Boiler Seasonal Efficiency = 80% New Boiler Seasonal Efficiency = 92%	3,551,130	-	3,087,939	0	F	$89,473	$1,600	25	463,191	0	463,191	$1,343.12	66.6	-$25,889	0.8
2200 MBTU Output Condensing Boiler Near Condensing Boiler Seasonal Efficiency = 80% New Boiler Seasonal Efficiency = 92%	3,551,130	-	3,087,939	0	I	$49,048	$1,600	25	463,191	0	463,191	$1,343.12	36.5	$14,536	1.2

** *Measure TRC = Measure cost + chg in annual O&M +PV Electricity Avoided Cost/Supply + PV Natural Gas Avoided Cost/Supply*
** *Considerations such as incentives, program delivery costs occur in later stages of the analysis*
** *1KWh = 3.6 MJ*

Assumptions:

Standard boiler input of 3.3 MBTU (1MW)and 30% loaded annual operating hours of 4,000 per year
Installed cost of near condensing and condensing boilers is from Viessmann
Purchase cost of standard boilers is $7/kBTU Input as per FortisBC Efficient Boiler Program definition
Electricity use and savings are negligible for boilers
Incremental maintenance for condensing boilers is assumed to be 2 days annually.
Boiler efficiency as per FortisBC Efficient Boiler Program
For Space Heating, and intermittant load

1 MBTU	1.055	MJ
	3300	MBTU input Boiler
	68%	Efficienct - Condensing Boiler
	80%	Efficient - near condensing
	92%	Efficient - Condensing
	4000	average operating hours
	30%	average load

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.045	$0.0121
Natural Gas	$0.016	$0.0103
Discount Rate	6.87%	

Financial & Economic Analysis - Energy-efficiency Measures

Efficiency Upgrades to a Constant Load Boilers

	Measure Description	Baseline Energy Use (MJ/yr.)		Upgrade Energy Use (MJ/yr.)		Measure Capital & Installation Cost F = full I=Incremental		Incremental O & M ($/yr)	Measure Life (yrs.)	Annual Energy Svg (MJ/yr.)		Participant Impact			Measure Total Resource Cost	B/C Ratio
		Natural Gas	Electricity	Natural Gas	Electricity					Natural Gas	Electricity	Annual Energy Svgs (MJ)	Annual Cost Svgs ($)	Simple Payback (yrs.)		
1	Burner and Control Upgrades on a Standard Efficiency Boiler (6% increase)	9,748,200		8,957,805	0	F	$24,498	$0	10	790,395	0	790,395	$8,166.07	3.0	$62,850	3.6
2	Burner and Control Upgrades on a Near Condensing Boiler (2% increase)	8,285,970		8,049,228	0	F	$24,498	$0	10	236,742	0	236,742	$2,445.94	10.0	$1,665	1.1
3	Boiler Economizer on 2200 MBTU Output Standard Efficiency Boiler Baseline Efficiency = 68% Upgrade Efficiency = 72%	9,748,200	-	9,206,633	0	F	$60,000	$0	25	541,567	0	541,567	$5,595.27	10.7	$39,874	1.7
2	Boiler Combustion Air Preheat on 2200 MBTU Output Standard Efficiency Boiler Baseline Efficiency = 68% Upgrade Efficiency = 72%	9,748,200	-	9,206,633	0	F	$60,000	$0	25	541,567	0	541,567	$5,595.27	10.7	$39,874	1.7
3	Boiler Advanced Control, Burner and Heat Recovery Bundle on a 2200 MBTU Output Standard Efficienecy Boiler Baseline Boiler Efficiency = 68% New Boiler Efficiency = 85%	9,748,200	-	7,798,560	0	F	$95,000	$0	25	1,949,640	0	1,949,640	$20,142.96	4.7	$264,546	3.8
4	Boiler Economizer on 2200 MBTU Output Near Condensing Boiler Baseline Efficiency = 80% Upgrade Efficiency = 84%	8,285,970	-	7,891,400	0	F	$60,000	$0	25	394,570	0	394,570	$4,076.56	14.7	$12,765	1.2
5	Boiler Combustion Air Preheat on 2200 MBTU Output Near Condensing Boiler Baseline Efficiency = 80% Upgrade Efficiency = 84%	8,285,970	-	7,891,400	0	F	$60,000	$0	25	394,570	0	394,570	$4,076.56	14.7	$12,765	1.2
6	Boiler Advanced Control, Burner and Heat Recovery Bundle on a 2200 MBTU Output Near Condensing Boiler Baseline Boiler Efficiency = 80% New Boiler Efficiency = 92%	8,285,970	-	6,833,790	0	F	$95,000	$0	25	1,452,180	0	1,452,180	$15,003.39	6.3	$172,806	2.8

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.045	$0.0121
Natural Gas	$0.016	$0.0064
Discount Rate	7.38%	

Financial & Economic Analysis - Energy-efficiency Measures

Measure Name: Efficiency Upgrades to a Constant Load Boilers

	Measure Description	Baseline Energy Use (MJ/yr.)		Upgrade Energy Use (MJ/yr.)		Measure Capital & Installation Cost F = full I=Incremental		Incremental O & M ($/yr)	Measure Life (yrs.)	Annual Energy Svg (MJ/yr.)		Participant Impact			Measure Total Resource Cost	B/C Ratio
		Natural Gas	Electricity	Natural Gas	Electricity					Natural Gas	Electricity	Annual Energy Svgs (MJ)	Annual Cost Svgs ($)	Simple Payback (yrs.)		
1	Burner and Control Upgrades on a Standard Efficiency Boiler (6% increase)	9,748,200		8,957,805	0	F	$15,067	$0	10	790,395	0	790,395	$5,022.17	3.0	$70,253	5.8
2	Burner and Control Upgrades on a Near Condensing Boiler (2% increase)	8,285,970		8,049,228	0	F	$15,067	$0	10	236,742	0	236,742	$1,504.27	10.0	$10,489	1.7
3	Boiler Economizer on 2200 MBTU Output Standard Efficiency Boiler Baseline Efficiency = 68% Upgrade Efficiency = 72%	9,748,200	-	9,206,633	0	F	$60,000	$0	25	541,567	0	541,567	$3,441.12	17.4	$35,418	1.7
4	Boiler Combustion Air Preheat on 2200 MBTU Output Standard Efficiency Boiler Baseline Efficiency = 68% Upgrade Efficiency = 72%	9,748,200	-	9,206,633	0	F	$60,000	$0	25	541,567	0	541,567	$3,441.12	17.4	$35,418	1.7
5	Boiler Advanced Control, Burner and Heat Recovery Bundle on a 2200 MBTU Output Standard Efficienecy Boiler Baseline Boiler Efficiency = 68% New Boiler Efficiency = 85%	9,748,200	-	7,798,560	0	F	$95,000	$0	25	1,949,640	0	1,949,640	$12,388.00	7.7	$248,505	3.8
6	Boiler Economizer on 2200 MBTU Output Near Condensing Boiler Baseline Efficiency = 80% Upgrade Efficiency = 84%	8,285,970	-	7,891,400	0	F	$60,000	$0	25	394,570	0	394,570	$2,507.11	23.9	$9,519	1.2
7	Boiler Combustion Air Preheat on 2200 MBTU Output Near Condensing Boiler Baseline Efficiency = 80% Upgrade Efficiency = 84%	8,285,970	-	7,891,400	0	F	$60,000	$0	25	394,570	0	394,570	$2,507.11	23.9	$9,519	1.2
8	Boiler Advanced Control, Burner and Heat Recovery Bundle on a 2200 MBTU Output Near Condensing Boiler Baseline Boiler Efficiency = 80% New Boiler Efficiency = 92%	8,285,970	-	6,833,790	0	F	$95,000	$0	25	1,452,180	0	1,452,180	$9,227.15	10.3	$160,858	2.8

Northern Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.045	$0.0121
Natural Gas	$0.016	$0.0064
Discount Rate	7.38%	

Financial & Economic Analysis - Energy-efficiency Measures

Measure Name: Efficiency Upgrades to a Constant Load Boilers

	Measure Description	Baseline Energy Use (MJ/yr.)		Upgrade Energy Use (MJ/yr.)		Measure Capital & Installation Cost F = full I=Incremental		Incremental O & M ($/yr)	Measure Life (yrs.)	Annual Energy Svg (MJ/yr.)		Participant Impact			Measure Total Resource Cost	B/C Ratio
		Natural Gas	Electricity	Natural Gas	Electricity					Natural Gas	Electricity	Annual Energy Svgs (MJ)	Annual Cost Svgs ($)	Simple Payback (yrs.)		
1	Burner and Control Upgrades on a Standard Efficiency Boiler (6% increase)	9,748,200		8,957,805	0	F	$15,067	$0	10	790,395	0	790,395	$5,022.17	3.0	$70,253	5.8
2	Burner and Control Upgrades on a Near Condensing Boiler (2% increase)	8,285,970		8,049,228	0	F	$15,067	$0	10	236,742	0	236,742	$1,504.27	10.0	$10,489	1.7
3	Boiler Economizer on 2200 MBTU Output Standard Efficiency Boiler Baseline Efficiency = 68% Upgrade Efficiency = 72%	9,748,200	-	9,206,633	0	F	$60,000	$0	25	541,567	0	541,567	$3,441.12	17.4	$35,418	1.7
4	Boiler Combustion Air Preheat on 2200 MBTU Output Standard Efficiency Boiler Baseline Efficiency = 68% Upgrade Efficiency = 72%	9,748,200	-	9,206,633	0	F	$60,000	$0	25	541,567	0	541,567	$3,441.12	17.4	$35,418	1.7
5	Boiler Advanced Control, Burner and Heat Recovery Bundle on a 2200 MBTU Output Standard Efficienecy Boiler Baseline Boiler Efficiency = 68% New Boiler Efficiency = 85%	9,748,200	-	7,798,560	0	F	$95,000	$0	25	1,949,640	0	1,949,640	$12,388.00	7.7	$248,505	3.8
6	Boiler Economizer on 2200 MBTU Output Near Condensing Boiler Baseline Efficiency = 80% Upgrade Efficiency = 84%	8,285,970	-	7,891,400	0	F	$60,000	$0	25	394,570	0	394,570	$2,507.11	23.9	$9,519	1.2
7	Boiler Combustion Air Preheat on 2200 MBTU Output Near Condensing Boiler Baseline Efficiency = 80% Upgrade Efficiency = 84%	8,285,970	-	7,891,400	0	F	$60,000	$0	25	394,570	0	394,570	$2,507.11	23.9	$9,519	1.2
8	Boiler Advanced Control, Burner and Heat Recovery Bundle on a 2200 MBTU Output Near Condensing Boiler Baseline Boiler Efficiency = 80% New Boiler Efficiency = 92%	8,285,970	-	6,833,790	0	F	$95,000	$0	25	1,452,180	0	1,452,180	$9,227.15	10.3	$160,858	2.8

Southern Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.045	$0.0121
Natural Gas	$0.016	$0.0064
Discount Rate	7.38%	

Financial & Economic Analysis - Energy-efficiency Measures

Measure Name: Efficiency Upgrades to a Constant Load Boilers

	Measure Description	Baseline Energy Use (MJ/yr.)		Upgrade Energy Use (MJ/yr.)		Measure Capital & Installation Cost F = full I=Incremental		Incremental O & M ($/yr)	Measure Life (yrs.)	Annual Energy Svg (MJ/yr.)		Participant Impact			Measure Total Resource Cost	B/C Ratio
		Natural Gas	Electricity	Natural Gas	Electricity					Natural Gas	Electricity	Annual Energy Svgs (MJ)	Annual Cost Svgs ($)	Simple Payback (yrs.)		
1	Burner and Control Upgrades on a Standard Efficiency Boiler (6% increase)	9,748,200		8,957,805	0	F	$15,067	$0	10	790,395	0	790,395	$5,022.17	3.0	$70,253	5.8
2	Burner and Control Upgrades on a Near Condensing Boiler (2% increase)	8,285,970		8,049,228	0	F	$15,067	$0	10	236,742	0	236,742	$1,504.27	10.0	$10,489	1.7
3	Boiler Economizer on 2200 MBTU Output Standard Efficiency Boiler Baseline Efficiency = 68% Upgrade Efficiency = 72%	9,748,200	-	9,206,633	0	F	$60,000	$0	25	541,567	0	541,567	$3,441.12	17.4	$35,418	1.7
4	Boiler Combustion Air Preheat on 2200 MBTU Output Standard Efficiency Boiler Baseline Efficiency = 68% Upgrade Efficiency = 72%	9,748,200	-	9,206,633	0	F	$60,000	$0	25	541,567	0	541,567	$3,441.12	17.4	$35,418	1.7
5	Boiler Advanced Control, Burner and Heat Recovery Bundle on a 2200 MBTU Output Standard Efficiency Boiler Baseline Boiler Efficiency = 68% New Boiler Efficiency = 85%	9,748,200	-	7,798,560	0	F	$95,000	$0	25	1,949,640	0	1,949,640	$12,388.00	7.7	$248,505	3.8
6	Boiler Economizer on 2200 MBTU Output Near Condensing Boiler Baseline Efficiency = 80% Upgrade Efficiency = 84%	8,285,970	-	7,891,400	0	F	$60,000	$0	25	394,570	0	394,570	$2,507.11	23.9	$9,519	1.2
7	Boiler Combustion Air Preheat on 2200 MBTU Output Near Condensing Boiler Baseline Efficiency = 80% Upgrade Efficiency = 84%	8,285,970	-	7,891,400	0	F	$60,000	$0	25	394,570	0	394,570	$2,507.11	23.9	$9,519	1.2
8	Boiler Advanced Control, Burner and Heat Recovery Bundle on a 2200 MBTU Output Near Condensing Boiler Baseline Boiler Efficiency = 80% New Boiler Efficiency = 92%	8,285,970	-	6,833,790	0	F	$95,000	$0	25	1,452,180	0	1,452,180	$9,227.15	10.3	$160,858	2.8

** *Measure TRC = Measure cost + chg in annual O&M +PV Electricity Avoided Cost/Supply + PV Natural Gas Avoided Cost/Supply*
** *Considerations such as incentives, program delivery costs occur in later stages of the analysis*
** *1KWh = 3.6 MJ*

Assumptions:

For process loads boilers will operate at full capacity 6,000 hours a year.
Installed cost is 2.5 times capital costs
A standard boiler input of 3.3 MMBtu/hr.
Choice of standard boiler size and operating hours based on average annual natural gas use of accounts in the manufacturing sub-sectors that use boilers.
Price and payback are from suppliers and literature as cited in the the Industrial Sector Report
Electricity use and savings are negligible for boilers
Incremental operating and maintenance costs are negligible for boilers

	0.04	Economizer Upgrade
	0.04	Combustion Air Preheat
	0.17	Bundled - on standard boiler
	0.12	Bundled - on near condensing
1 MBTU	1.055	MJ
	3300	MBTU input Boiler
	68%	Efficienct - Condensing Boiler
	80%	Efficient - near condensing
	92%	Efficient - Condensing
	4000	average operating hours
	70%	average load

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.045	$0.0121
Natural Gas	$0.016	$0.0103
Discount Rate	6.87%	

Financial & Economic Analysis - Energy-efficiency Measures

Add-on Condensing Heat Exchanger Large Boilers

	Measure Description	Baseline Energy Use (MJ/yr.)		Upgrade Energy Use (MJ/yr.)		Measure Capital & Installation Cost F = full I=Incremental		Incremental O & M ($/yr)	Measure Life (yrs.)	Annual Energy Svg (MJ/yr.)		Participant Impact			Measure Total Resource Cost	B/C Ratio
		Natural Gas	Electricity	Natural Gas	Electricity					Natural Gas	Electricity	Annual Energy Svgs (MJ)	Annual Cost Svgs ($)	Simple Payback (yrs.)		
1	Boiler Exhaust Stack Condensing Heat Exchanger add-on: 50,000 lbs/hour Standard Efficiency Boiler Baseline Efficiency = 68% Upgrade Efficiency = 83%	315,234,000	-	258,264,000	241,704	F	$641,203	$5,000	25	56,970,000	-241,704	56,728,296	$580,663.13	1.1	$9,679,111	12.7
2	Boiler Exhaust Stack Condensing Heat Exchanger add-on: 50,000 lbs/hour Standard Efficiency Boiler Baseline Efficiency = 80% Upgrade Efficiency = 90%	267,948,900	-	238,176,800	241,704	F	$641,203	$5,000	25	29,772,100	-241,704	29,530,396	$299,664.68	2.1	$4,663,367	6.6

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.045	$0.0121
Natural Gas	$0.016	$0.0064
Discount Rate	7.38%	

Financial & Economic Analysis - Energy-efficiency Measures

Add-on Condensing Heat Exchanger Large Boilers

	Measure Description	Baseline Energy Use (MJ/yr.)		Upgrade Energy Use (MJ/yr.)		Measure Capital & Installation Cost F = full I=Incremental		Incremental O & M ($/yr)	Measure Life (yrs.)	Annual Energy Svg (MJ/yr.)		Participant Impact			Measure Total Resource Cost	B/C Ratio
		Natural Gas	Electricity	Natural Gas	Electricity					Natural Gas	Electricity	Annual Energy Svgs (MJ)	Annual Cost Svgs ($)	Simple Payback (yrs.)		
1	Boiler Exhaust Stack Condensing Heat Exchanger add-on: 50,000 lbs/hour Standard Efficiency Boiler Baseline Efficiency = 68% Upgrade Efficiency = 83%	315,234,000	-	258,264,000	241,704	F	$641,203	$5,000	25	56,970,000	-241,704	56,728,296	$354,057.36	1.8	$9,218,679	12.7
2	Boiler Exhaust Stack Condensing Heat Exchanger add-on: 50,000 lbs/hour Standard Efficiency Boiler Baseline Efficiency = 80% Upgrade Efficiency = 90%	267,948,900	-	238,176,800	241,704	F	$641,203	$5,000	25	29,772,100	-241,704	29,530,396	$181,242.18	3.5	$4,426,709	6.6

Northern Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.045	$0.0121
Natural Gas	$0.016	$0.0064
Discount Rate	7.38%	

Financial & Economic Analysis - Energy-efficiency Measures

Add-on Condensing Heat Exchanger Large Boilers

	Measure Description	Baseline Energy Use (MJ/yr.)		Upgrade Energy Use (MJ/yr.)		Measure Capital & Installation Cost F = full I=Incremental		Incremental O & M ($/yr)	Measure Life (yrs.)	Annual Energy Svg (MJ/yr.)		Participant Impact			Measure Total Resource Cost	B/C Ratio
		Natural Gas	Electricity	Natural Gas	Electricity					Natural Gas	Electricity	Annual Energy Svgs (MJ)	Annual Cost Svgs ($)	Simple Payback (yrs.)		
1	Boiler Exhaust Stack Condensing Heat Exchanger add-on: 50,000 lbs/hour Standard Efficiency Boiler Baseline Efficiency = 68% Upgrade Efficiency = 83%	315,234,000	-	258,264,000	241,704	F	$641,203	$5,000	25	56,970,000	-241,704	56,728,296	$354,057.36	1.8	$9,218,679	12.7
2	Boiler Exhaust Stack Condensing Heat Exchanger add-on: 50,000 lbs/hour Standard Efficiency Boiler Baseline Efficiency = 80% Upgrade Efficiency = 90%	267,948,900	-	238,176,800	241,704	F	$641,203	$5,000	25	29,772,100	-241,704	29,530,396	$181,242.18	3.5	$4,426,709	6.6

Southern Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.045	$0.0121
Natural Gas	$0.016	$0.0064
Discount Rate	7.38%	

Financial & Economic Analysis - Energy-efficiency Measures

Add-on Condensing Heat Exchanger Large Boilers

	Measure Description	Baseline Energy Use (MJ/yr.)		Upgrade Energy Use (MJ/yr.)		Measure Capital & Installation Cost F = full I=Incremental		Incremental O & M ($/yr)	Measure Life (yrs.)	Annual Energy Svg (MJ/yr.)		Participant Impact			Measure Total Resource Cost	B/C Ratio
		Natural Gas	Electricity	Natural Gas	Electricity					Natural Gas	Electricity	Annual Energy Svgs (MJ)	Annual Cost Svgs ($)	Simple Payback (yrs.)		
1	Boiler Exhaust Stack Condensing Heat Exchanger add-on: 50,000 lbs/hour Standard Efficiency Boiler Baseline Efficiency = 68% Upgrade Efficiency = 83%	315,234,000	-	258,264,000	241,704	F	$641,203	$5,000	25	56,970,000	-241,704	56,728,296	$354,057.36	1.8	$9,218,679	12.7
2	Boiler Exhaust Stack Condensing Heat Exchanger add-on: 50,000 lbs/hour Standard Efficiency Boiler Baseline Efficiency = 80% Upgrade Efficiency = 90%	267,948,900	-	238,176,800	241,704	F	$641,203	$5,000	25	29,772,100	-241,704	29,530,396	$181,242.18	3.5	$4,426,709	6.6

** *Measure TRC = Measure cost + chg in annual O&M +PV Electricity Avoided Cost/Supply + PV Natural Gas Avoided Cost/Supply*
** *Considerations such as incentives, program delivery costs occur in later stages of the analysis*
** *1KWh = 3.6 MJ*

Assumptions:

For process loads boilers will operate at 60 capacity 6,000 hours a year.
see numbers below for assumptions

50,000 lbs/hour boiler = 16.5 MW output (approx) = 20.6 MW input at 80% = 24.3 MW input at 68% effienicny

	15%	Condenser on standard boiler
	10%	Condenser on near condensing boiler
	$641,203	Heat Exchanger Cost (50,000 lbs/h boiler)
1 MBTU	1.055	MJ
	83000	MBTU input Boiler (150 lbs steam)
	68%	Efficienct - Condensing Boiler
	80%	Efficient - near condensing
	92%	Efficient - Condensing
	6000	average operating hours
	60%	average load

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.045	$0.0121
Natural Gas	$0.014	$0.0103
Discount Rate	6.87%	

Financial & Economic Analysis - Energy-efficiency Measures

Direct Contact Hot Water Heating

	Measure Description	Baseline Energy Use (MJ/yr.) Natural Gas	Baseline Energy Use (MJ/yr.) Electricity	Upgrade Energy Use (MJ/yr.) Natural Gas	Upgrade Energy Use (MJ/yr.) Electricity	Measure Capital & Installation Cost F = full I=Incremental		Incremental O & M ($/yr)	Measure Life (yrs.)	Annual Energy Svg (MJ/yr.) Natural Gas	Annual Energy Svg (MJ/yr.) Electricity	Participant Impact Annual Energy Svgs (MJ)	Participant Impact Annual Cost Svgs ($)	Participant Impact Simple Payback (yrs.)	Measure Total Resource Cost	B/C Ratio
1	**Change to Direct-fired Water Heating (3200 MBTU Unit) Baseline Efficiency = 75% Upgrade Efficiency = 95%**	14,179,200	-	11,194,105	0	F	$200,000	$0	15	2,985,095	0	2,985,095	$30,840.89	6.5	$190,630	2.0
2	**Change to Direct-fired Water Heating (3200 MBTU Unit) Baseline Efficiency = 75% Upgrade Efficiency = 95%**	14,179,200	-	11,194,105	0	I	$111,840	$0	15	2,985,095	0	2,985,095	$30,840.89	3.6	$278,790	3.5

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.045	$0.0121
Natural Gas	$0.014	$0.0064
Discount Rate	7.38%	

Financial & Economic Analysis - Energy-efficiency Measures

Measure Name: Direct Contact Hot Water Heating

	Measure Description	Baseline Energy Use (MJ/yr.) Natural Gas	Baseline Energy Use (MJ/yr.) Electricity	Upgrade Energy Use (MJ/yr.) Natural Gas	Upgrade Energy Use (MJ/yr.) Electricity	Measure Capital & Installation Cost F = full I=Incremental		Incremental O & M ($/yr)	Measure Life (yrs.)	Annual Energy Svg (MJ/yr.) Natural Gas	Annual Energy Svg (MJ/yr.) Electricity	Participant Impact Annual Energy Svgs (MJ)	Participant Impact Annual Cost Svgs ($)	Participant Impact Simple Payback (yrs.)	Measure Total Resource Cost	B/C Ratio
1	**Change to Direct-fired Water Heating (3200 MBTU Unit) Baseline Efficiency = 75% Upgrade Efficiency = 95%**	14,179,200	-	11,194,105	0	F	$200,000	$0	15	2,985,095	0	2,985,095	$18,967.27	10.5	$178,299	1.9
2	**Change to Direct-fired Water Heating (3200 MBTU Unit) Baseline Efficiency = 75% Upgrade Efficiency = 95%**	14,179,200	-	11,194,105	0	I	$111,840	$0	15	2,985,095	0	2,985,095	$18,967.27	5.9	$266,459	3.4

Northern Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.045	$0.0121
Natural Gas	$0.014	$0.0064
Discount Rate	7.38%	

Financial & Economic Analysis - Energy-efficiency Measures

Measure Name: Direct Contact Hot Water Heating

	Measure Description	Baseline Energy Use (MJ/yr.) Natural Gas	Baseline Energy Use (MJ/yr.) Electricity	Upgrade Energy Use (MJ/yr.) Natural Gas	Upgrade Energy Use (MJ/yr.) Electricity	Measure Capital & Installation Cost F = full I=Incremental		Incremental O & M ($/yr)	Measure Life (yrs.)	Annual Energy Svg (MJ/yr.) Natural Gas	Annual Energy Svg (MJ/yr.) Electricity	Participant Impact Annual Energy Svgs (MJ)	Participant Impact Annual Cost Svgs ($)	Participant Impact Simple Payback (yrs.)	Measure Total Resource Cost	B/C Ratio
1	**Change to Direct-fired Water Heating (3200 MBTU Unit) Baseline Efficiency = 75% Upgrade Efficiency = 95%**	14,179,200	-	11,194,105	0	F	$200,000	$0	15	2,985,095	0	2,985,095	$18,967.27	10.5	$178,299	1.9
2	**Change to Direct-fired Water Heating (3200 MBTU Unit) Baseline Efficiency = 75% Upgrade Efficiency = 95%**	14,179,200	-	11,194,105	0	I	$111,840	$0	15	2,985,095	0	2,985,095	$18,967.27	5.9	$266,459	3.4

Southern Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.045	$0.0121
Natural Gas	$0.014	$0.0064
Discount Rate	7.38%	

Financial & Economic Analysis - Energy-efficiency Measures

Measure Name: Direct Contact Hot Water Heating

	Measure Description	Baseline Energy Use (MJ/yr.) Natural Gas	Baseline Energy Use (MJ/yr.) Electricity	Upgrade Energy Use (MJ/yr.) Natural Gas	Upgrade Energy Use (MJ/yr.) Electricity	Measure Capital & Installation Cost F = full I=Incremental		Incremental O & M ($/yr)	Measure Life (yrs.)	Annual Energy Svg (MJ/yr.) Natural Gas	Annual Energy Svg (MJ/yr.) Electricity	Participant Impact Annual Energy Svgs (MJ)	Participant Impact Annual Cost Svgs ($)	Participant Impact Simple Payback (yrs.)	Measure Total Resource Cost	B/C Ratio
1	**Change to Direct-fired Water Heating (3200 MBTU Unit) Baseline Efficiency = 75% Upgrade Efficiency = 95%**	14,179,200	-	11,194,105	0	F	$200,000	$0	15	2,985,095	0	2,985,095	$18,967.27	10.5	$178,299	1.9
2	**Change to Direct-fired Water Heating (3200 MBTU Unit) Baseline Efficiency = 75% Upgrade Efficiency = 95%**	14,179,200	-	11,194,105	0	I	$111,840	$0	15	2,985,095	0	2,985,095	$18,967.27	5.9	$266,459	3.4

** *Measure TRC = Measure cost + chg in annual O&M +PV Electricity Avoided Cost/Supply + PV Natural Gas Avoided Cost/Supply*

** *Considerations such as incentives, program delivery costs occur in later stages of the analysis*

** *1KWh = 3.6 MJ*

Assumptions:

Cost of tank type water heater from R S Means average of $25/kBTU
Installed cost assumed to be 2.5 times purchase cost
Cost of Direct-fired hot water heater from manufacturers as referenced in the report.
Electricity use and savings are negligible hot water heaters
Incremental operating and maintenance costs are negligible for hote water heaters

1 MBTU	1.055	MJ
	3200	MBTU input Boiler
	75%	Water Heater Efficiency
	95%	Direct-fired Water Heater
	6000	average operating hours
	70%	average load

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.045	$0.0121
Natural Gas	$0.014	$0.0103
Discount Rate	6.87%	

Financial & Economic Analysis - Energy-efficiency Measures

High-efficiency Ovens

	Measure Description	Baseline Energy Use (MJ/yr.)		Upgrade Energy Use (MJ/yr.)		Measure Capital & Installation Cost F = full I=Incremental		Incremental O & M ($/yr)	Measure Life (yrs.)	Annual Energy Svg (MJ/yr.)		Participant Impact			Measure Total Resource Cost	B/C Ratio
		Natural Gas	Electricity	Natural Gas	Electricity					Natural Gas	Electricity	Annual Energy Svgs (MJ)	Annual Cost Svgs ($)	Simple Payback (yrs.)		
1	Change to 45 MBTU High-efficiency Oven Baseline Efficiency = 65% Upgrade Efficiency = 80%	140,700	-	114,319	0	I	$818	$0	15	26,381	0	26,381	$273	3.0	$2,635	4.2

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.045	$0.0121
Natural Gas	$0.014	$0.0064
Discount Rate	7.38%	

Financial & Economic Analysis - Energy-efficiency Measures

Measure Name: High-efficiency Ovens

	Measure Description	Baseline Energy Use (MJ/yr.)		Upgrade Energy Use (MJ/yr.)		Measure Capital & Installation Cost F = full I=Incremental		Incremental O & M ($/yr)	Measure Life (yrs.)	Annual Energy Svg (MJ/yr.)		Participant Impact			Measure Total Resource Cost	B/C Ratio
		Natural Gas	Electricity	Natural Gas	Electricity					Natural Gas	Electricity	Annual Energy Svgs (MJ)	Annual Cost Svgs ($)	Simple Payback (yrs.)		
1	Change to 45 MBTU High-efficiency Oven Baseline Efficiency = 65% Upgrade Efficiency = 80%	140,700	-	114,319	0	I	$503	$0	15	26,381	0	26,381	$168	3.0	$2,840	6.6

Northern Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.045	$0.0121
Natural Gas	$0.014	$0.0064
Discount Rate	7.38%	

Financial & Economic Analysis - Energy-efficiency Measures

Measure Name: High-efficiency Ovens

	Measure Description	Baseline Energy Use (MJ/yr.)		Upgrade Energy Use (MJ/yr.)		Measure Capital & Installation Cost F = full I=Incremental		Incremental O & M ($/yr)	Measure Life (yrs.)	Annual Energy Svg (MJ/yr.)		Participant Impact			Measure Total Resource Cost	B/C Ratio
		Natural Gas	Electricity	Natural Gas	Electricity					Natural Gas	Electricity	Annual Energy Svgs (MJ)	Annual Cost Svgs ($)	Simple Payback (yrs.)		
1	Change to 45 MBTU High-efficiency Oven Baseline Efficiency = 65% Upgrade Efficiency = 80%	140,700	-	114,319	0	I	$503	$0	15	26,381	0	26,381	$168	3.0	$2,840	6.6

Southern Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.045	$0.0121
Natural Gas	$0.014	$0.0064
Discount Rate	7.38%	

Financial & Economic Analysis - Energy-efficiency Measures

Measure Name: High-efficiency Ovens

	Measure Description	Baseline Energy Use (MJ/yr.)		Upgrade Energy Use (MJ/yr.)		Measure Capital & Installation Cost F = full I=Incremental		Incremental O & M ($/yr)	Measure Life (yrs.)	Annual Energy Svg (MJ/yr.)		Participant Impact			Measure Total Resource Cost	B/C Ratio
		Natural Gas	Electricity	Natural Gas	Electricity					Natural Gas	Electricity	Annual Energy Svgs (MJ)	Annual Cost Svgs ($)	Simple Payback (yrs.)		
1	Change to 45 MBTU High-efficiency Oven Baseline Efficiency = 65% Upgrade Efficiency = 80%	140,700	-	114,319	0	I	$503	$0	15	26,381	0	26,381	$168	3.0	$2,840	6.6

** *Measure TRC = Measure cost + chg in annual O&M +PV Electricity Avoided Cost/Supply + PV Natural Gas Avoided Cost/Supply*

** *Considerations such as incentives, program delivery costs occur in later stages of the analysis*

** *1KWh = 3.6 MJ*

Assumptions:

For process loads furnaces operate at 4,000 hours a year, 75% loaded.

A oven standard capacity of 45,000 Btu/hr is used

Price and payback are from suppliers and literature as cited in the the Industrial Sector Report

Electricity use and savings are negligible

Incremental operating and maintenance costs are negligible

3 year payback is assumed

65.00% standard efficiency oven

80% High-efficiency oven

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.045	$0.0121
Natural Gas	$0.014	$0.0103
Discount Rate	6.87%	

Financial & Economic Analysis - Energy-efficiency Measures

Heat Treating and Annealing Burner Upgrade

	Measure Description	Baseline Energy Use (MJ/yr.)		Upgrade Energy Use (MJ/yr.)		Measure Capital & Installation Cost F = full I=Incremental		Incremental O & M ($/yr)	Measure Life (yrs.)	Annual Energy Svg (MJ/yr.)		Participant Impact			Measure Total Resource Cost	B/C Ratio
		Natural Gas	Electricity	Natural Gas	Electricity					Natural Gas	Electricity	Annual Energy Svgs (MJ)	Annual Cost Svgs ($)	Simple Payback (yrs.)		
9	4000 MBTU Furnace with Sequential Firing, High-velocity Burners Baseline Efficiency = 25% Upgrade Efficiency = 40%	12,660,000	-	7,912,500	0	I	$147,148	$0	15	4,747,500	0	4,747,500	$49,049	3.0	$474,111	4.2

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.045	$0.0121
Natural Gas	$0.014	$0.0064
Discount Rate	7.38%	

Financial & Economic Analysis - Energy-efficiency Measures

Measure Name: Heat Treating and Annealing Burner Upgrade

	Measure Description	Baseline Energy Use (MJ/yr.)		Upgrade Energy Use (MJ/yr.)		Measure Capital & Installation Cost F = full I=Incremental		Incremental O & M ($/yr)	Measure Life (yrs.)	Annual Energy Svg (MJ/yr.)		Participant Impact			Measure Total Resource Cost	B/C Ratio
		Natural Gas	Electricity	Natural Gas	Electricity					Natural Gas	Electricity	Annual Energy Svgs (MJ)	Annual Cost Svgs ($)	Simple Payback (yrs.)		
9	4000 MBTU Furnace with Sequential Firing, High-velocity Burners Baseline Efficiency = 25% Upgrade Efficiency = 40%	12,660,000	-	7,912,500	0	I	$90,497	$0	15	4,747,500	0	4,747,500	$30,166	3.0	$511,150	6.6

Northern Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.045	$0.0121
Natural Gas	$0.014	$0.0064
Discount Rate	7.38%	

Financial & Economic Analysis - Energy-efficiency Measures

Measure Name: Heat Treating and Annealing Burner Upgrade

	Measure Description	Baseline Energy Use (MJ/yr.)		Upgrade Energy Use (MJ/yr.)		Measure Capital & Installation Cost F = full I=Incremental		Incremental O & M ($/yr)	Measure Life (yrs.)	Annual Energy Svg (MJ/yr.)		Participant Impact			Measure Total Resource Cost	B/C Ratio
		Natural Gas	Electricity	Natural Gas	Electricity					Natural Gas	Electricity	Annual Energy Svgs (MJ)	Annual Cost Svgs ($)	Simple Payback (yrs.)		
9	4000 MBTU Furnace with Sequential Firing, High-velocity Burners Baseline Efficiency = 25% Upgrade Efficiency = 40%	12,660,000	-	7,912,500	0	I	$90,497	$0	15	4,747,500	0	4,747,500	$30,166	3.0	$511,150	6.6

Southern Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.045	$0.0121
Natural Gas	$0.014	$0.0064
Discount Rate	7.38%	

Financial & Economic Analysis - Energy-efficiency Measures

Measure Name: Heat Treating and Annealing Burner Upgrade

	Measure Description	Baseline Energy Use (MJ/yr.)		Upgrade Energy Use (MJ/yr.)		Measure Capital & Installation Cost F = full I=Incremental		Incremental O & M ($/yr)	Measure Life (yrs.)	Annual Energy Svg (MJ/yr.)		Participant Impact			Measure Total Resource Cost	B/C Ratio
		Natural Gas	Electricity	Natural Gas	Electricity					Natural Gas	Electricity	Annual Energy Svgs (MJ)	Annual Cost Svgs ($)	Simple Payback (yrs.)		
9	4000 MBTU Furnace with Sequential Firing, High-velocity Burners Baseline Efficiency = 25% Upgrade Efficiency = 40%	12,660,000	-	7,912,500	0	I	$90,497	$0	15	4,747,500	0	4,747,500	$30,166	3.0	$511,150	6.6

** *Measure TRC = Measure cost + chg in annual O&M +PV Electricity Avoided Cost/Supply + PV Natural Gas Avoided Cost/Supply*

** *Considerations such as incentives, program delivery costs occur in later stages of the analysis*

** *1KWh = 3.6 MJ*

Assumptions:

For process loads furnaces operate at 4,000 hours a year, 75% loaded.

A standard burner capacity of 4 MMBtu/hr is used

Price and payback are from suppliers and literature as cited in the the Industrial Sector Report

Electricity use and savings are negligible

Based on literature, a 3 year payback is typical

Incremental operating and maintenance costs are negligible

25% efficiency of *Standard efficiency heat treating furnace*

40% efficiency of *efficiency heat treating furnace*

Financial & Economic Analysis - Energy-efficiency Measures

Optimized Heat Balance and Control

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.045	$0.0121
Natural Gas	$0.013	$0.0103
Discount Rate	6.87%	

	Measure Description	Baseline Energy Use (MJ/yr.)		Upgrade Energy Use (MJ/yr.)		Measure Capital & Installation Cost F = full I=Incremental		Incremental O & M ($/yr)	Measure Life (yrs.)	Annual Energy Svg (MJ/yr.)		Participant Impact			Measure Total Resource Cost	B/C Ratio
		Natural Gas	Electricity	Natural Gas	Electricity					Natural Gas	Electricity	Annual Energy Svgs (MJ)	Annual Cost Svgs ($)	Simple Payback (yrs.)		
1	Optimize Heat Balance and Control Process Efficiency Increase = 10%	200,000,000	-	180,000,000	0	F	$826,530	$0	10	20,000,000	0	20,000,000	$206,632	4.0	$1,006,386	2.2

Financial & Economic Analysis - Energy-efficiency Measures

Measure Name: Optimized Heat Balance and Control

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.045	$0.0121
Natural Gas	$0.013	$0.0064
Discount Rate	7.38%	

	Measure Description	Baseline Energy Use (MJ/yr.)		Upgrade Energy Use (MJ/yr.)		Measure Capital & Installation Cost F = full I=Incremental		Incremental O & M ($/yr)	Measure Life (yrs.)	Annual Energy Svg (MJ/yr.)		Participant Impact			Measure Total Resource Cost	B/C Ratio
		Natural Gas	Electricity	Natural Gas	Electricity					Natural Gas	Electricity	Annual Energy Svgs (MJ)	Annual Cost Svgs ($)	Simple Payback (yrs.)		
1	Optimize Heat Balance and Control Process Efficiency Increase = 10%	200,000,000	-	180,000,000	0	F	$508,319	$0	10	20,000,000	0	20,000,000	$127,080	4.0	$1,282,021	3.5

Financial & Economic Analysis - Energy-efficiency Measures

Measure Name: Optimized Heat Balance and Control

Northern Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.045	$0.0121
Natural Gas	$0.013	$0.0064
Discount Rate	7.38%	

	Measure Description	Baseline Energy Use (MJ/yr.)		Upgrade Energy Use (MJ/yr.)		Measure Capital & Installation Cost F = full I=Incremental		Incremental O & M ($/yr)	Measure Life (yrs.)	Annual Energy Svg (MJ/yr.)		Participant Impact			Measure Total Resource Cost	B/C Ratio
		Natural Gas	Electricity	Natural Gas	Electricity					Natural Gas	Electricity	Annual Energy Svgs (MJ)	Annual Cost Svgs ($)	Simple Payback (yrs.)		
1	Optimize Heat Balance and Control Process Efficiency Increase = 10%	200,000,000	-	180,000,000	0	F	$508,319	$0	10	20,000,000	0	20,000,000	$127,080	4.0	$1,282,021	3.5

Financial & Economic Analysis - Energy-efficiency Measures

Measure Name: Optimized Heat Balance and Control

Southern Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.045	$0.0121
Natural Gas	$0.013	$0.0064
Discount Rate	7.38%	

	Measure Description	Baseline Energy Use (MJ/yr.)		Upgrade Energy Use (MJ/yr.)		Measure Capital & Installation Cost F = full I=Incremental		Incremental O & M ($/yr)	Measure Life (yrs.)	Annual Energy Svg (MJ/yr.)		Participant Impact			Measure Total Resource Cost	B/C Ratio
		Natural Gas	Electricity	Natural Gas	Electricity					Natural Gas	Electricity	Annual Energy Svgs (MJ)	Annual Cost Svgs ($)	Simple Payback (yrs.)		
1	Optimize Heat Balance and Control Process Efficiency Increase = 10%	200,000,000	-	180,000,000	0	F	$508,319	$0	10	20,000,000	0	20,000,000	$127,080	4.0	$1,282,021	3.5

** *Measure TRC = Measure cost + chg in annual O&M +PV Electricity Avoided Cost/Supply + PV Natural Gas Avoided Cost/Supply*

** *Considerations such as incentives, program delivery costs occur in later stages of the analysis*

** *1KWh = 3.6 MJ*

Assumptions:

Price and payback are from suppliers and literature as cited in the the Industrial Sector Report

Standard size based on average annual gas use 2,000,000 GJ.

4 year payback is assumed

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.045	$0.0121
Natural Gas	$0.014	$0.0103
Discount Rate	6.87%	

Financial & Economic Analysis - Energy-efficiency Measures

Lumber Dry Kiln and Veneer Dryer Upgrades

	Measure Description	Baseline Energy Use (MJ/yr.)		Upgrade Energy Use (MJ/yr.)		Measure Capital & Installation Cost F = full I=Incremental		Incremental O & M ($/yr)	Measure Life (yrs.)	Annual Energy Svg (MJ/yr.)		Participant Impact			Measure Total Resource Cost	B/C Ratio
		Natural Gas	Electricity	Natural Gas	Electricity					Natural Gas	Electricity	Annual Energy Svgs (MJ)	Annual Cost Svgs ($)	Simple Payback (yrs.)		
14	Upgrade To Efficient Lumber Dry Kiln Baseline Nat Gas Efficiency = 57% Upgrade Natural Gas Efficiency = 87% Electrical Energy Reduction = 20%	59,400,000	2,414,880	38,917,241	1,931,904	I	$869,895	$0	15	20,482,759	482,976	20,965,735	$217,474	4.0	$2,008,032	3.3
15	Upgrade To High-efficiency Veneer Dryer Natural Gas Use Reduction = 20%	59,400,000	-	47,520,000	0	I	$368,219	$0	15	11,880,000	0	11,880,000	$122,739.68	3.0	$1,186,400	4.2

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.045	$0.0121
Natural Gas	$0.014	$0.0064
Discount Rate	7.38%	

Financial & Economic Analysis - Energy-efficiency Measures

Measure Name: Lumber Dry Kiln and Veneer Dryer Upgrades

	Measure Description	Baseline Energy Use (MJ/yr.)		Upgrade Energy Use (MJ/yr.)		Measure Capital & Installation Cost F = full I=Incremental		Incremental O & M ($/yr)	Measure Life (yrs.)	Annual Energy Svg (MJ/yr.)		Participant Impact			Measure Total Resource Cost	B/C Ratio
		Natural Gas	Electricity	Natural Gas	Electricity					Natural Gas	Electricity	Annual Energy Svgs (MJ)	Annual Cost Svgs ($)	Simple Payback (yrs.)		
14	Upgrade To Efficient Lumber Dry Kiln Baseline Nat Gas Efficiency = 57% Upgrade Natural Gas Efficiency = 87% Electrical Energy Reduction = 20%	59,400,000	2,414,880	38,917,241	1,931,904	I	$544,003	$0	15	20,482,759	482,976	20,965,735	$136,001	4.0	$2,243,074	5.1
15	Upgrade To High-efficiency Veneer Dryer Natural Gas Use Reduction = 20%	59,400,000	-	47,520,000	0	I	$226,456	$0	15	11,880,000	0	11,880,000	$75,485.40	3.0	$1,279,087	6.6

Northern Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.045	$0.0121
Natural Gas	$0.014	$0.0064
Discount Rate	7.38%	

Financial & Economic Analysis - Energy-efficiency Measures

Measure Name: Lumber Dry Kiln and Veneer Dryer Upgrades

	Measure Description	Baseline Energy Use (MJ/yr.)		Upgrade Energy Use (MJ/yr.)		Measure Capital & Installation Cost F = full I=Incremental		Incremental O & M ($/yr)	Measure Life (yrs.)	Annual Energy Svg (MJ/yr.)		Participant Impact			Measure Total Resource Cost	B/C Ratio
		Natural Gas	Electricity	Natural Gas	Electricity					Natural Gas	Electricity	Annual Energy Svgs (MJ)	Annual Cost Svgs ($)	Simple Payback (yrs.)		
14	Upgrade To Efficient Lumber Dry Kiln Baseline Nat Gas Efficiency = 57% Upgrade Natural Gas Efficiency = 87% Electrical Energy Reduction = 20%	59,400,000	2,414,880	38,917,241	1,931,904	I	$544,003	$0	15	20,482,759	482,976	20,965,735	$136,001	4.0	$2,243,074	5.1
15	Upgrade To High-efficiency Veneer Dryer Natural Gas Use Reduction = 20%	59,400,000	-	47,520,000	0	I	$226,456	$0	15	11,880,000	0	11,880,000	$75,485.40	3.0	$1,279,087	6.6

Southern Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.045	$0.0121
Natural Gas	$0.014	$0.0064
Discount Rate	7.38%	

Financial & Economic Analysis - Energy-efficiency Measures

Measure Name: Lumber Dry Kiln and Veneer Dryer Upgrades

	Measure Description	Baseline Energy Use (MJ/yr.)		Upgrade Energy Use (MJ/yr.)		Measure Capital & Installation Cost F = full I=Incremental		Incremental O & M ($/yr)	Measure Life (yrs.)	Annual Energy Svg (MJ/yr.)		Participant Impact			Measure Total Resource Cost	B/C Ratio
		Natural Gas	Electricity	Natural Gas	Electricity					Natural Gas	Electricity	Annual Energy Svgs (MJ)	Annual Cost Svgs ($)	Simple Payback (yrs.)		
14	Upgrade To Efficient Lumber Dry Kiln Baseline Nat Gas Efficiency = 57% Upgrade Natural Gas Efficiency = 87% Electrical Energy Reduction = 20%	59,400,000	2,414,880	38,917,241	1,931,904	I	$544,003	$0	15	20,482,759	482,976	20,965,735	$136,001	4.0	$2,243,074	5.1
15	Upgrade To High-efficiency Veneer Dryer Natural Gas Use Reduction = 20%	59,400,000	-	47,520,000	0	I	$226,456	$0	15	11,880,000	0	11,880,000	$75,485.40	3.0	$1,279,087	6.6

** *Measure TRC = Measure cost + chg in annual O&M +PV Electricity Avoided Cost/Supply + PV Natural Gas Avoided Cost/Supply*

** *Considerations such as incentives, program delivery costs occur in later stages of the analysis*

** *1KWh = 3.6 MJ*

Assumptions:

Price and payback are from suppliers and literature as cited in the the Industrial Sector Report

Standard size based on discussions with manufacturers as cited in the Industrial Sector Report

4 year payback for kilns

3 year payback for veneer dryer

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.045	$0.0121
Natural Gas	$0.016	$0.0103
Discount Rate	6.87%	

Financial & Economic Analysis - Energy-efficiency Measures

Direct Gas-fired Paper Drying

	Measure Description	Baseline Energy Use (MJ/yr.)		Upgrade Energy Use (MJ/yr.)		Measure Capital & Installation Cost F = full I=Incremental		Incremental O & M ($/yr)	Measure Life (yrs.)	Annual Energy Svg (MJ/yr.)		Participant Impact			Measure Total Resource Cost	B/C Ratio
		Natural Gas	Electricity	Natural Gas	Electricity					Natural Gas	Electricity	Annual Energy Svgs (MJ)	Annual Cost Svgs ($)	Simple Payback (yrs.)		
1	Convert To Direct-fired Paper Drying - Process Efficiency Increase = 7.3%	1,000,000,000	-	927,000,000	0	I	$2,262,625	$0	25	73,000,000	0	73,000,000	$754,208	3.0	$11,199,784	5.9

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.045	$0.0121
Natural Gas	$0.016	$0.0064
Discount Rate	7.38%	

Financial & Economic Analysis - Energy-efficiency Measures

Measure Name: Direct Gas-fired Paper Drying

	Measure Description	Baseline Energy Use (MJ/yr.)		Upgrade Energy Use (MJ/yr.)		Measure Capital & Installation Cost F = full I=Incremental		Incremental O & M ($/yr)	Measure Life (yrs.)	Annual Energy Svg (MJ/yr.)		Participant Impact			Measure Total Resource Cost	B/C Ratio
		Natural Gas	Electricity	Natural Gas	Electricity					Natural Gas	Electricity	Annual Energy Svgs (MJ)	Annual Cost Svgs ($)	Simple Payback (yrs.)		
1	Convert To Direct-fired Paper Drying - Process Efficiency Increase = 7.3%	1,000,000,000	-	927,000,000	0	I	$1,391,524	$0	25	73,000,000	0	73,000,000	$463,841	3.0	$11,470,272	9.2

Northern Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.045	$0.0121
Natural Gas	$0.016	$0.0064
Discount Rate	7.38%	

Financial & Economic Analysis - Energy-efficiency Measures

Measure Name: Direct Gas-fired Paper Drying

	Measure Description	Baseline Energy Use (MJ/yr.)		Upgrade Energy Use (MJ/yr.)		Measure Capital & Installation Cost F = full I=Incremental		Incremental O & M ($/yr)	Measure Life (yrs.)	Annual Energy Svg (MJ/yr.)		Participant Impact			Measure Total Resource Cost	B/C Ratio
		Natural Gas	Electricity	Natural Gas	Electricity					Natural Gas	Electricity	Annual Energy Svgs (MJ)	Annual Cost Svgs ($)	Simple Payback (yrs.)		
1	Convert To Direct-fired Paper Drying - Process Efficiency Increase = 7.3%	1,000,000,000	-	927,000,000	0	I	$1,391,524	$0	25	73,000,000	0	73,000,000	$463,841	3.0	$11,470,272	9.2

Southern Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.045	$0.0121
Natural Gas	$0.016	$0.0064
Discount Rate	7.38%	

Financial & Economic Analysis - Energy-efficiency Measures

Measure Name: Direct Gas-fired Paper Drying

	Measure Description	Baseline Energy Use (MJ/yr.)		Upgrade Energy Use (MJ/yr.)		Measure Capital & Installation Cost F = full I=Incremental		Incremental O & M ($/yr)	Measure Life (yrs.)	Annual Energy Svg (MJ/yr.)		Participant Impact			Measure Total Resource Cost	B/C Ratio
		Natural Gas	Electricity	Natural Gas	Electricity					Natural Gas	Electricity	Annual Energy Svgs (MJ)	Annual Cost Svgs ($)	Simple Payback (yrs.)		
1	Convert To Direct-fired Paper Drying - Process Efficiency Increase = 7.3%	1,000,000,000	-	927,000,000	0	I	$1,391,524	$0	25	73,000,000	0	73,000,000	$463,841	3.0	$11,470,272	9.2

** *Measure TRC = Measure cost + chg in annual O&M +PV Electricity Avoided Cost/Supply + PV Natural Gas Avoided Cost/Supply*

** *Considerations such as incentives, program delivery costs occur in later stages of the analysis*

** *1KWh = 3.6 MJ*

Assumptions:

Standard size based on average annual gas use 1,000,000 GJ.

3 year payback is assumed

Northern Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.045	$0.0121
Natural Gas	$0.014	$0.0064
Discount Rate	7.38%	

Financial & Economic Analysis - Energy-efficiency Measures

Pulp Lime Kilns

Measure Description	Baseline Energy Use (MJ/yr.) Natural Gas	Baseline Energy Use (MJ/yr.) Electricity	Upgrade Energy Use (MJ/yr.) Natural Gas	Upgrade Energy Use (MJ/yr.) Electricity	Measure Capital & Installation Cost F = full I=Incremental		Incremental O & M ($/yr)	Measure Life (yrs.)	Annual Energy Svg (MJ/yr.) Natural Gas	Annual Energy Svg (MJ/yr.) Electricity	Participant Impact Annual Energy Svgs (MJ)	Participant Impact Annual Cost Svgs ($)	Participant Impact Simple Payback (yrs.)	Measure Total Resource Cost	B/C Ratio
Add Insulation to Pulp Lime Kilns	3,148,096,000	-	2,990,691,200	0	F	$2,833,286	$0	15	157,404,800	0	157,404,800	$1,000,148.48	2.8	$17,114,507	7.0
Upgrade Kiln Burner and Optimize Control	3,148,096,000	-	3,022,172,160	0	F	$1,511,086	$0	8	125,923,840	0	125,923,840	$800,118.78	1.9	$9,047,885	7.0

** *Measure TRC = Measure cost + chg in annual O&M +PV Electricity Avoided Cost/Supply + PV Natural Gas Avoided Cost/Supply*

** *Considerations such as incentives, program delivery costs occur in later stages of the analysis*

** *1KWh = 3.6 MJ*

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.045	$0.0121
Natural Gas	$0.016	$0.0103
Discount Rate	6.87%	

Financial & Economic Analysis - Energy-efficiency Measures

Upgrade Cement Kiln Burners and Control

Measure Description		Baseline Energy Use (MJ/yr.)		Upgrade Energy Use (MJ/yr.)		Measure Capital & Installation Cost F = full I=Incremental		Incremental O & M ($/yr)	Measure Life (yrs.)	Annual Energy Svg (MJ/yr.)		Participant Impact			Measure Total Resource Cost	B/C Ratio
		Natural Gas	Electricity	Natural Gas	Electricity					Natural Gas	Electricity	Annual Energy Svgs (MJ)	Annual Cost Svgs ($)	Simple Payback (yrs.)		
1	Upgrade Cement Kiln Burners and Control = 11% efficiency improvement	200,000,000	-	178,000,000	0	F	$396,000	$0	20	22,000,000	0	22,000,000	$227,296	1.7	$3,286,311	9.3

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.045	$0.0121
Natural Gas	$0.016	$0.0064
Discount Rate	7.38%	

Financial & Economic Analysis - Energy-efficiency Measures

Measure Name: Upgrade Cement Kiln Burners and Control

Measure Description		Baseline Energy Use (MJ/yr.)		Upgrade Energy Use (MJ/yr.)		Measure Capital & Installation Cost F = full I=Incremental		Incremental O & M ($/yr)	Measure Life (yrs.)	Annual Energy Svg (MJ/yr.)		Participant Impact			Measure Total Resource Cost	B/C Ratio
		Natural Gas	Electricity	Natural Gas	Electricity					Natural Gas	Electricity	Annual Energy Svgs (MJ)	Annual Cost Svgs ($)	Simple Payback (yrs.)		
1	Upgrade Cement Kiln Burners and Control = 11% efficiency improvement	200,000,000	-	178,000,000	0	F	$396,000	$0	20	22,000,000	0	22,000,000	$139,788	2.8	$3,143,963	8.9

Northern Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.045	$0.0121
Natural Gas	$0.016	$0.0064
Discount Rate	7.38%	

Financial & Economic Analysis - Energy-efficiency Measures

Measure Name: Upgrade Cement Kiln Burners and Control

Measure Description		Baseline Energy Use (MJ/yr.)		Upgrade Energy Use (MJ/yr.)		Measure Capital & Installation Cost F = full I=Incremental		Incremental O & M ($/yr)	Measure Life (yrs.)	Annual Energy Svg (MJ/yr.)		Participant Impact			Measure Total Resource Cost	B/C Ratio
		Natural Gas	Electricity	Natural Gas	Electricity					Natural Gas	Electricity	Annual Energy Svgs (MJ)	Annual Cost Svgs ($)	Simple Payback (yrs.)		
1	Upgrade Cement Kiln Burners and Control = 11% efficiency improvement	200,000,000	-	178,000,000	0	F	$396,000	$0	20	22,000,000	0	22,000,000	$139,788	2.8	$3,143,963	8.9

Southern Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.045	$0.0121
Natural Gas	$0.016	$0.0064
Discount Rate	7.38%	

Financial & Economic Analysis - Energy-efficiency Measures

Measure Name: Upgrade Cement Kiln Burners and Control

Measure Description		Baseline Energy Use (MJ/yr.)		Upgrade Energy Use (MJ/yr.)		Measure Capital & Installation Cost F = full I=Incremental		Incremental O & M ($/yr)	Measure Life (yrs.)	Annual Energy Svg (MJ/yr.)		Participant Impact			Measure Total Resource Cost	B/C Ratio
		Natural Gas	Electricity	Natural Gas	Electricity					Natural Gas	Electricity	Annual Energy Svgs (MJ)	Annual Cost Svgs ($)	Simple Payback (yrs.)		
1	Upgrade Cement Kiln Burners and Control = 11% efficiency improvement	200,000,000	-	178,000,000	0	F	$396,000	$0	20	22,000,000	0	22,000,000	$139,788	2.8	$3,143,963	8.9

** *Measure TRC = Measure cost + chg in annual O&M +PV Electricity Avoided Cost/Supply + PV Natural Gas Avoided Cost/Supply*

** *Considerations such as incentives, program delivery costs occur in later stages of the analysis*

** *1KWh = 3.6 MJ*

Assumptions:

Standard size based on average annual gas use 200,000 GJ.

3 year payback is assumed at 6$/GJ

Northern Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.045	$0.0121
Natural Gas	$0.014	$0.0064
Discount Rate	7.38%	

Financial & Economic Analysis - Energy-efficiency Measures

Copper Concentrate

Measure Description	Baseline Energy Use (MJ/yr.)		Upgrade Energy Use (MJ/yr.)		Measure Capital & Installation Cost F = full I=Incremental		Incremental O & M ($/yr)	Measure Life (yrs.)	Annual Energy Svg (MJ/yr.)		Participant Impact			Measure Total Resource Cost	B/C Ratio
	Natural Gas	Electricity	Natural Gas	Electricity					Natural Gas	Electricity	Annual Energy Svgs (MJ)	Annual Cost Svgs ($)	Simple Payback (yrs.)		
Replace heated matte launders with un-heated water cooled launders	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Optimize concentrate dryer	145,710,000	-	138,425,000	0	I	$135,000	$0	25	7,285,000	0	7,285,000	$46,288.82	2.9	$1,034,463	8.7
Other	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Southern Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.045	$0.0121
Natural Gas	$0.014	$0.0064
Discount Rate	7.38%	

Financial & Economic Analysis - Energy-efficiency Measures

Coal Drying

Measure Description	Baseline Energy Use (MJ/yr.)		Upgrade Energy Use (MJ/yr.)		Measure Capital & Installation Cost F = full I=Incremental		Incremental O & M ($/yr)	Measure Life (yrs.)	Annual Energy Svg (MJ/yr.)		Participant Impact			Measure Total Resource Cost	B/C Ratio
	Natural Gas	Electricity	Natural Gas	Electricity					Natural Gas	Electricity	Annual Energy Svgs (MJ)	Annual Cost Svgs ($)	Simple Payback (yrs.)		
Conventional (Non-Vibrating) Fluid Bed Thermal Dryers with In-Bed Heat Exchangers	1,642,354,000	-	1,478,118,600	0	I	$1,700,000	$0	25	164,235,400	0	164,235,400	$1,043,550	1.6	$24,664,749	15.5
Conventional Flash or Tornesh Flash Thermal Dryers	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vibrating Fluid Bed Dryers	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

** *Measure TRC = Measure cost + chg in annual O&M +PV Electricity Avoided Cost/Supply + PV Natural Gas Avoided Cost/Supply*

** *Considerations such as incentives, program delivery costs occur in later stages of the analysis*

** *1KWh = 3.6 MJ*

Assumptions:

Assume upgrade will improve efficiency by 10%.

Estimated Natural Gas Used for Coal Drying		1,642,354 GJ/yr
	Estimated Savings	164,235 GJ/yr
Estimated Capital Costs, 3 year payback at $6/GJ		$ 985,412

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.045	$0.0214
Natural Gas	$0.016	$0.0103
Discount Rate	6.87%	

Financial & Economic Analysis - Energy-efficiency Measures

Condensing Turbine

Measure Description	Baseline Energy Use (MJ/yr.)		Upgrade Energy Use (MJ/yr.)		Measure Capital & Installation Cost F = full I=Incremental		Incremental O & M ($/yr)	Measure Life (yrs.)	Annual Energy Svg (MJ/yr.)		Participant Impact			Measure Total Resource Cost	B/C Ratio
	Natural Gas	Electricity	Natural Gas	Electricity					Natural Gas	Electricity	Annual Energy Svgs (MJ)	Annual Cost Svgs ($)	Simple Payback (yrs.)		
Condensing Turbine Added to improve control of existing steam system and to produce power	15,000,000,000	546,381,256	11,383,850,000	0	F	$71,422,386	$35,128,310	20	3,616,150,000	546,381,256	4,162,531,256	$13,924,947.18	5.1	$418,343,703	1.9

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.045	$0.0214
Natural Gas	$0.016	$0.0064
Discount Rate	7.38%	

Financial & Economic Analysis - Energy-efficiency Measures

Condensing Turbine

Measure Description	Baseline Energy Use (MJ/yr.)		Upgrade Energy Use (MJ/yr.)		Measure Capital & Installation Cost F = full I=Incremental		Incremental O & M ($/yr)	Measure Life (yrs.)	Annual Energy Svg (MJ/yr.)		Participant Impact			Measure Total Resource Cost	B/C Ratio
	Natural Gas	Electricity	Natural Gas	Electricity					Natural Gas	Electricity	Annual Energy Svgs (MJ)	Annual Cost Svgs ($)	Simple Payback (yrs.)		
Condensing Turbine Added to improve control of existing steam system and to produce power	1,151,878,000	44,703,921	856,011,000	0	F	$5,843,650	$2,874,134	20	295,867,000	44,703,921	340,570,921	-$37,534.69	-155.7	$32,679,085	1.9

Northern Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.045	$0.0214
Natural Gas	$0.016	$0.0064
Discount Rate	7.38%	

Financial & Economic Analysis - Energy-efficiency Measures

Condensing Turbine

Measure Description	Baseline Energy Use (MJ/yr.)		Upgrade Energy Use (MJ/yr.)		Measure Capital & Installation Cost F = full I=Incremental		Incremental O & M ($/yr)	Measure Life (yrs.)	Annual Energy Svg (MJ/yr.)		Participant Impact			Measure Total Resource Cost	B/C Ratio
	Natural Gas	Electricity	Natural Gas	Electricity					Natural Gas	Electricity	Annual Energy Svgs (MJ)	Annual Cost Svgs ($)	Simple Payback (yrs.)		
Condensing Turbine Added to improve control of existing steam system and to produce power	9,991,530,000	437,379,052	7,096,796,000	0	F	$57,173,732	$28,120,267	20	2,894,734,000	437,379,052	3,332,113,052	-$367,245.61	-155.7	$319,728,917	1.9

Southern Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.045	$0.0214
Natural Gas	$0.016	$0.0064
Discount Rate	7.38%	

Financial & Economic Analysis - Energy-efficiency Measures

Condensing Turbine

Measure Description	Baseline Energy Use (MJ/yr.)		Upgrade Energy Use (MJ/yr.)		Measure Capital & Installation Cost F = full I=Incremental		Incremental O & M ($/yr)	Measure Life (yrs.)	Annual Energy Svg (MJ/yr.)		Participant Impact			Measure Total Resource Cost	B/C Ratio
	Natural Gas	Electricity	Natural Gas	Electricity					Natural Gas	Electricity	Annual Energy Svgs (MJ)	Annual Cost Svgs ($)	Simple Payback (yrs.)		
Condensing Turbine Added to improve control of existing steam system and to produce power	712,051,000	58,234,993	326,630,000	0	F	$7,612,417	$3,744,083	20	385,421,000	58,234,993	443,655,993	-$48,893.30	-155.7	$42,570,518	1.9

** *Measure TRC = Measure cost + chg in annual O&M +PV Electricity Avoided Cost/Supply + PV Natural Gas Avoided Cost/Supply*

** *Considerations such as incentives, program delivery costs occur in later stages of the analysis*

** *1KWh = 3.6 MJ*

Financial & Economic Analysis - Energy-efficiency Measures

Asphalt Hot Mix Plant Upgrades

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.045	$0.0121
Natural Gas	$0.014	$0.0103
Discount Rate	6.87%	

	Measure Description	Baseline Energy Use (MJ/yr.)		Upgrade Energy Use (MJ/yr.)		Measure Capital & Installation Cost F = full I=Incremental		Incremental O & M ($/yr)	Measure Life (yrs.)	Annual Energy Svg (MJ/yr.)		Participant Impact			Measure Total Resource Cost	B/C Ratio
		Natural Gas	Electricity	Natural Gas	Electricity					Natural Gas	Electricity	Annual Energy Svgs (MJ)	Annual Cost Svgs ($)	Simple Payback (yrs.)		
1	Upgrade Asphalt Hot Mix Plant Baseline Efficiency = 70% Upgrade Efficiency = 80%	50,000,000	-	43,750,000	0	F	$150,000	$0	15	6,250,000	0	6,250,000	$64,572.64	2.3	$667,876	5.5

Financial & Economic Analysis - Energy-efficiency Measures

Asphalt Hot Mix Plant Upgrades

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.045	$0.0121
Natural Gas	$0.014	$0.0064
Discount Rate	7.38%	

	Measure Description	Baseline Energy Use (MJ/yr.)		Upgrade Energy Use (MJ/yr.)		Measure Capital & Installation Cost F = full I=Incremental		Incremental O & M ($/yr)	Measure Life (yrs.)	Annual Energy Svg (MJ/yr.)		Participant Impact			Measure Total Resource Cost	B/C Ratio
		Natural Gas	Electricity	Natural Gas	Electricity					Natural Gas	Electricity	Annual Energy Svgs (MJ)	Annual Cost Svgs ($)	Simple Payback (yrs.)		
1	Upgrade Asphalt Hot Mix Plant Baseline Efficiency = 70% Upgrade Efficiency = 80%	50,000,000	-	43,750,000	0	F	$150,000	$0	15	6,250,000	0	6,250,000	$39,712.44	3.8	$642,058	5.3

Financial & Economic Analysis - Energy-efficiency Measures

Asphalt Hot Mix Plant Upgrades

Northern Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.045	$0.0121
Natural Gas	$0.014	$0.0064
Discount Rate	7.38%	

	Measure Description	Baseline Energy Use (MJ/yr.)		Upgrade Energy Use (MJ/yr.)		Measure Capital & Installation Cost F = full I=Incremental		Incremental O & M ($/yr)	Measure Life (yrs.)	Annual Energy Svg (MJ/yr.)		Participant Impact			Measure Total Resource Cost	B/C Ratio
		Natural Gas	Electricity	Natural Gas	Electricity					Natural Gas	Electricity	Annual Energy Svgs (MJ)	Annual Cost Svgs ($)	Simple Payback (yrs.)		
1	Upgrade Asphalt Hot Mix Plant Baseline Efficiency = 70% Upgrade Efficiency = 80%	50,000,000	-	43,750,000	0	F	$150,000	$0	15	6,250,000	0	6,250,000	$39,712.44	3.8	$642,058	5.3

Financial & Economic Analysis - Energy-efficiency Measures

Asphalt Hot Mix Plant Upgrades

Southern Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.045	$0.0121
Natural Gas	$0.014	$0.0064
Discount Rate	7.38%	

	Measure Description	Baseline Energy Use (MJ/yr.)		Upgrade Energy Use (MJ/yr.)		Measure Capital & Installation Cost F = full I=Incremental		Incremental O & M ($/yr)	Measure Life (yrs.)	Annual Energy Svg (MJ/yr.)		Participant Impact			Measure Total Resource Cost	B/C Ratio
		Natural Gas	Electricity	Natural Gas	Electricity					Natural Gas	Electricity	Annual Energy Svgs (MJ)	Annual Cost Svgs ($)	Simple Payback (yrs.)		
1	Upgrade Asphalt Hot Mix Plant Baseline Efficiency = 70% Upgrade Efficiency = 80%	50,000,000	-	43,750,000	0	F	$150,000	$0	15	6,250,000	0	6,250,000	$39,712.44	3.8	$642,058	5.3

** *Measure TRC = Measure cost + chg in annual O&M +PV Electricity Avoided Cost/Supply + PV Natural Gas Avoided Cost/Supply*

** *Considerations such as incentives, program delivery costs occur in later stages of the analysis*

** *1KWh = 3.6 MJ*

Assumptions:

Plant consumes 50,000 GWH/year
Literatrue says energy/ tonne produced varies by 20% in the sector
Assumed a 10% efficiency increase for a lower efficiency plant.
Electricity use and savings are negligible
assume a 4 year payback based on $6/GJ gas is typical
Incremental operating and maintenance costs are negligible

70% efficiency of	*Standard efficiency hot mix plant*
80% efficiency of	*upgraded hot mix plant*

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.045	$0.0121
Natural Gas	$0.016	$0.0064
Discount Rate	7.38%	

Financial & Economic Analysis - Energy-efficiency Measures

Upgrade Gypsum Plant

	Measure Description	Baseline Energy Use (MJ/yr.)		Upgrade Energy Use (MJ/yr.)		Measure Capital & Installation Cost F = full I=Incremental		Incremental O & M ($/yr)	Measure Life (yrs.)	Annual Energy Svg (MJ/yr.)		Participant Impact			Measure Total Resource Cost	B/C Ratio
		Natural Gas	Electricity	Natural Gas	Electricity					Natural Gas	Electricity	Annual Energy Svgs (MJ)	Annual Cost Svgs ($)	Simple Payback (yrs.)		
1	Upgrade Gypsum Plant from 81% efficiency to 90%	451,000,000	-	405,900,000	0	F	$1,082,400	$0	25	45,100,000	0	45,100,000	$286,564.94	3.8	$6,863,723	7.3

** *Measure TRC = Measure cost + chg in annual O&M +PV Electricity Avoided Cost/Supply + PV Natural Gas Avoided Cost/Supply*

** *Considerations such as incentives, program delivery costs occur in later stages of the analysis*

** *1KWh = 3.6 MJ*

Assumptions:

CertainTeed Gypsum stated that efficiency upgrade from existing 81% to 90% is reasonable, and has been done in their other plants.
CertainTeed uses 451 000 GJ of gas annually

Electricity use and savings are negligible
Based on literature, a 4 year payback at $6/GJ is typical
Incremental operating and maintenance costs are negligible

81%	efficiency of	Existing Plant
90%	efficiency of	Upgraded Plant

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.045	$0.0121
Natural Gas	$0.016	$0.0064
Discount Rate	7.38%	

Financial & Economic Analysis - Energy-efficiency Measures

Add Energy Screens to Greenhouse (Enclosure Upgrade)

	Measure Description	Baseline Energy Use (MJ/yr.)		Upgrade Energy Use (MJ/yr.)		Measure Capital & Installation Cost F = full I=Incremental		Incremental O & M ($/yr)	Measure Life (yrs.)	Annual Energy Svg (MJ/yr.)		Participant Impact			Measure Total Resource Cost	B/C Ratio
		Natural Gas	Electricity	Natural Gas	Electricity					Natural Gas	Electricity	Annual Energy Svgs (MJ)	Annual Cost Svgs ($)	Simple Payback (yrs.)		
1	Add Energy Screens to Greenhouse (Enclosure Upgrade)	36,000,000	-	29,880,000	0	F	$197,000	$0	25	6,120,000	0	6,120,000	$38,886.42	5.1	$881,277	5.5

Southern Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.045	$0.0121
Natural Gas	$0.016	$0.0064
Discount Rate	7.38%	

Financial & Economic Analysis - Energy-efficiency Measures

Add Energy Screens to Greenhouse (Enclosure Upgrade)

	Measure Description	Baseline Energy Use (MJ/yr.)		Upgrade Energy Use (MJ/yr.)		Measure Capital & Installation Cost F = full I=Incremental		Incremental O & M ($/yr)	Measure Life (yrs.)	Annual Energy Svg (MJ/yr.)		Participant Impact			Measure Total Resource Cost	B/C Ratio
		Natural Gas	Electricity	Natural Gas	Electricity					Natural Gas	Electricity	Annual Energy Svgs (MJ)	Annual Cost Svgs ($)	Simple Payback (yrs.)		
1	Add Energy Screens to Greenhouse (Enclosure Upgrade)	36,000,000	-	29,880,000	0	F	$197,000	$0	25	6,120,000	0	6,120,000	$38,886.42	5.1	$881,277	5.5

** *Measure TRC = Measure cost + chg in annual O&M +PV Electricity Avoided Cost/Supply + PV Natural Gas Avoided Cost/Supply*

** *Considerations such as incentives, program delivery costs occur in later stages of the analysis*

** *1KWh = 3.6 MJ*

Assumptions:

Based on the Mount Lehman installation of an energy screen that was done and incented by NRCAN
217,000 sq. feet of greenhouse, requiring 36,000 GJ of gas using a 90% efficent boiler
17% energy savings by installing a curtain

Electricity use and savings are negligible
$197,000 capital costs including installation
Incremental operating and maintenance costs are negligible

Financial & Economic Analysis - Energy-efficiency Measures

Install IC engine cogeneration unit (139 kW electrical output)

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.045	$0.0214
Natural Gas	$0.014	$0.0103
Discount Rate	6.87%	

	Measure Description	Baseline Energy Use (MJ/yr.)		Upgrade Energy Use (MJ/yr.)		Measure Capital & Installation Cost F = full I=Incremental		Incremental O & M ($/yr)	Measure Life (yrs.)	Annual Energy Svg (MJ/yr.)		Participant Impact			Measure Total Resource Cost	B/C Ratio
		Natural Gas	Electricity	Natural Gas	Electricity					Natural Gas	Electricity	Annual Energy Svgs (MJ)	Annual Cost Svgs ($)	Simple Payback (yrs.)		
1	Install IC engine cogeneration unit (139 kW electrical output)	8,059,200	-	14,103,600	-4,383,504	F	$660,000	$21,900	15	-6,044,400	4,383,504	-1,660,896	$9,458.52	69.8	$140,873	1.1

Financial & Economic Analysis - Energy-efficiency Measures

Install IC engine cogeneration unit (139 kW electrical output)

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.045	$0.0214
Natural Gas	$0.014	$0.0064
Discount Rate	7.38%	

	Measure Description	Baseline Energy Use (MJ/yr.)		Upgrade Energy Use (MJ/yr.)		Measure Capital & Installation Cost F = full I=Incremental		Incremental O & M ($/yr)	Measure Life (yrs.)	Annual Energy Svg (MJ/yr.)		Participant Impact			Measure Total Resource Cost	B/C Ratio
		Natural Gas	Electricity	Natural Gas	Electricity					Natural Gas	Electricity	Annual Energy Svgs (MJ)	Annual Cost Svgs ($)	Simple Payback (yrs.)		
1	Install IC engine cogeneration unit (139 kW electrical output)	8,059,200	-	14,103,600	-4,383,504	F	$660,000	$0	15	-6,044,400	4,383,504	-1,660,896	$55,400.93	11.9	$310,354	1.2

Financial & Economic Analysis - Energy-efficiency Measures

Install IC engine cogeneration unit (139 kW electrical output)

Northern Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.045	$0.0214
Natural Gas	$0.014	$0.0064
Discount Rate	7.38%	

	Measure Description	Baseline Energy Use (MJ/yr.)		Upgrade Energy Use (MJ/yr.)		Measure Capital & Installation Cost F = full I=Incremental		Incremental O & M ($/yr)	Measure Life (yrs.)	Annual Energy Svg (MJ/yr.)		Participant Impact			Measure Total Resource Cost	B/C Ratio
		Natural Gas	Electricity	Natural Gas	Electricity					Natural Gas	Electricity	Annual Energy Svgs (MJ)	Annual Cost Svgs ($)	Simple Payback (yrs.)		
1	Install IC engine cogeneration unit (139 kW electrical output)	8,059,200	-	14,103,600	-4,383,504	F	$660,000	$0	15	-6,044,400	4,383,504	-1,660,896	$55,400.93	11.9	$310,354	1.2

Financial & Economic Analysis - Energy-efficiency Measures

Install IC engine cogeneration unit (139 kW electrical output)

Southern Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.045	$0.0214
Natural Gas	$0.014	$0.0064
Discount Rate	7.38%	

	Measure Description	Baseline Energy Use (MJ/yr.)		Upgrade Energy Use (MJ/yr.)		Measure Capital & Installation Cost F = full I=Incremental		Incremental O & M ($/yr)	Measure Life (yrs.)	Annual Energy Svg (MJ/yr.)		Participant Impact			Measure Total Resource Cost	B/C Ratio
		Natural Gas	Electricity	Natural Gas	Electricity					Natural Gas	Electricity	Annual Energy Svgs (MJ)	Annual Cost Svgs ($)	Simple Payback (yrs.)		
1	Install IC engine cogeneration unit (139 kW electrical output)	8,059,200	-	14,103,600	-4,383,504	F	$660,000	$0	15	-6,044,400	4,383,504	-1,660,896	$55,400.93	11.9	$310,354	1.2

** *Measure TRC = Measure cost + chg in annual O&M +PV Electricity Avoided Cost/Supply + PV Natural Gas Avoided Cost/Supply*

** *Considerations such as incentives, program delivery costs occur in later stages of the analysis*

** *1KWh = 3.6 MJ*

Assumptions:

Based on 1.61 GH/h fuel input (139 kW unit) provided by EnerG

Electricity out 139 kW, Heat Out - 230 kW = .828 GJ/hour

Price Quoted = $460,000 for material, Installation estimated at 200,000 including electrical interconnect

Maintenance quoted at $2.50/hour = 21900

Based on literature, a 3 year payback is typical

Incremental operating and maintenance costs are negligible

Operating hours	*8760*	
Fuel Input	*1.61*	*GJ/Hour*
Electricity output	*139*	*kW*
heat output	*0.828*	*GJ/hour*
Boiler efficinecy	*90%*	

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.045	$0.0121
Natural Gas	$0.016	$0.0103
Discount Rate	6.87%	

Financial & Economic Analysis - Energy-efficiency Measures

Distribution System Insulation

	Measure Description	Baseline Energy Use (MJ/yr.)		Upgrade Energy Use (MJ/yr.)		Measure Capital & Installation Cost F = full I=Incremental		Incremental O & M ($/yr)	Measure Life (yrs.)	Annual Energy Svg (MJ/yr.)		Participant Impact			Measure Total Resource Cost	B/C Ratio
		Natural Gas	Electricity	Natural Gas	Electricity					Natural Gas	Electricity	Annual Energy Svgs (MJ)	Annual Cost Svgs ($)	Simple Payback (yrs.)		
1	Distribution System Insulation Baseline Efficiency = 50% Upgrade Efficiency = 92%	815,000	-	124,000	0	F	$10,709	$0	20	691,000	0	691,000	$7,139.15	1.5	$104,949	10.8

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.045	$0.0121
Natural Gas	$0.016	$0.0064
Discount Rate	7.38%	

Financial & Economic Analysis - Energy-efficiency Measures

Measure Name: Distribution System Insulation

	Measure Description	Baseline Energy Use (MJ/yr.)		Upgrade Energy Use (MJ/yr.)		Measure Capital & Installation Cost F = full I=Incremental		Incremental O & M ($/yr)	Measure Life (yrs.)	Annual Energy Svg (MJ/yr.)		Participant Impact			Measure Total Resource Cost	B/C Ratio
		Natural Gas	Electricity	Natural Gas	Electricity					Natural Gas	Electricity	Annual Energy Svgs (MJ)	Annual Cost Svgs ($)	Simple Payback (yrs.)		
1	Distribution System Insulation Baseline Efficiency = 50% Upgrade Efficiency = 92%	815,000	-	124,000	0	F	$6,586	$0	20	691,000	0	691,000	$4,390.61	1.5	$104,601	16.9

Northern Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.045	$0.0121
Natural Gas	$0.016	$0.0064
Discount Rate	7.38%	

Financial & Economic Analysis - Energy-efficiency Measures

Measure Name: Distribution System Insulation

	Measure Description	Baseline Energy Use (MJ/yr.)		Upgrade Energy Use (MJ/yr.)		Measure Capital & Installation Cost F = full I=Incremental		Incremental O & M ($/yr)	Measure Life (yrs.)	Annual Energy Svg (MJ/yr.)		Participant Impact			Measure Total Resource Cost	B/C Ratio
		Natural Gas	Electricity	Natural Gas	Electricity					Natural Gas	Electricity	Annual Energy Svgs (MJ)	Annual Cost Svgs ($)	Simple Payback (yrs.)		
1	Distribution System Insulation Baseline Efficiency = 50% Upgrade Efficiency = 92%	815,000	-	124,000	0	F	$6,586	$0	20	691,000	0	691,000	$4,390.61	1.5	$104,601	16.9

Southern Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.045	$0.0121
Natural Gas	$0.016	$0.0064
Discount Rate	7.38%	

Financial & Economic Analysis - Energy-efficiency Measures

Measure Name: Distribution System Insulation

	Measure Description	Baseline Energy Use (MJ/yr.)		Upgrade Energy Use (MJ/yr.)		Measure Capital & Installation Cost F = full I=Incremental		Incremental O & M ($/yr)	Measure Life (yrs.)	Annual Energy Svg (MJ/yr.)		Participant Impact			Measure Total Resource Cost	B/C Ratio
		Natural Gas	Electricity	Natural Gas	Electricity					Natural Gas	Electricity	Annual Energy Svgs (MJ)	Annual Cost Svgs ($)	Simple Payback (yrs.)		
1	Distribution System Insulation Baseline Efficiency = 50% Upgrade Efficiency = 92%	815,000	-	124,000	0	F	$6,586	$0	20	691,000	0	691,000	$4,390.61	1.5	$104,601	16.9

** *Measure TRC = Measure cost + chg in annual O&M +PV Electricity Avoided Cost/Supply + PV Natural Gas Avoided Cost/Supply*
** *Considerations such as incentives, program delivery costs occur in later stages of the analysis*
** *1KWh = 3.6 MJ*

Assumptions:

Analysis is based on standard length of piping per plant of 815 feet, pipe diameter of 2 ", and insulation thickness of 1". See Report Section 4 for sizing details and assumptions.
Gas savings and efficiency values are based on North American Insulation Manufacturers Association (NAIMA) published heat loss values
Capital and installation cost as NAIMA
(works out to 1.5 year payback as per NAIMA)

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.045	$0.0121
Natural Gas	$0.014	$0.0103
Discount Rate	6.87%	

Financial & Economic Analysis - Energy-efficiency Measures

Heat Treating and Annealing Oven Insulation Upgrade

	Measure Description	Baseline Energy Use (MJ/yr.)		Upgrade Energy Use (MJ/yr.)		Measure Capital & Installation Cost F = full I=Incremental		Incremental O & M ($/yr)	Measure Life (yrs.)	Annual Energy Svg (MJ/yr.)		Participant Impact			Measure Total Resource Cost	B/C Ratio
		Natural Gas	Electricity	Natural Gas	Electricity					Natural Gas	Electricity	Annual Energy Svgs (MJ)	Annual Cost Svgs ($)	Simple Payback (yrs.)		
11	**Ceramic Fibre Insulation on 4000 MBTU Furnance Baseline Efficiency = 25% Upgrade Efficiency = 40%**	12,660,000	-	7,912,500	0	F	$147,148	$0	15	4,747,500	0	4,747,500	$49,049.39	3.0	$474,111	4.2

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.045	$0.0121
Natural Gas	$0.014	$0.0064
Discount Rate	7.38%	

Financial & Economic Analysis - Energy-efficiency Measures

Measure Name: Heat Treating and Annealing Oven Insulation Upgrade

	Measure Description	Baseline Energy Use (MJ/yr.)		Upgrade Energy Use (MJ/yr.)		Measure Capital & Installation Cost F = full I=Incremental		Incremental O & M ($/yr)	Measure Life (yrs.)	Annual Energy Svg (MJ/yr.)		Participant Impact			Measure Total Resource Cost	B/C Ratio
		Natural Gas	Electricity	Natural Gas	Electricity					Natural Gas	Electricity	Annual Energy Svgs (MJ)	Annual Cost Svgs ($)	Simple Payback (yrs.)		
11	**Ceramic Fibre Insulation on 4000 MBTU Furnance Baseline Efficiency = 25% Upgrade Efficiency = 40%**	12,660,000	-	7,912,500	0	F	$90,497	$0	15	4,747,500	0	4,747,500	$30,165.57	3.0	$511,150	6.6

Northern Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.045	$0.0121
Natural Gas	$0.014	$0.0064
Discount Rate	7.38%	

Financial & Economic Analysis - Energy-efficiency Measures

Measure Name: Heat Treating and Annealing Oven Insulation Upgrade

	Measure Description	Baseline Energy Use (MJ/yr.)		Upgrade Energy Use (MJ/yr.)		Measure Capital & Installation Cost F = full I=Incremental		Incremental O & M ($/yr)	Measure Life (yrs.)	Annual Energy Svg (MJ/yr.)		Participant Impact			Measure Total Resource Cost	B/C Ratio
		Natural Gas	Electricity	Natural Gas	Electricity					Natural Gas	Electricity	Annual Energy Svgs (MJ)	Annual Cost Svgs ($)	Simple Payback (yrs.)		
11	**Ceramic Fibre Insulation on 4000 MBTU Furnance Baseline Efficiency = 25% Upgrade Efficiency = 40%**	12,660,000	-	7,912,500	0	F	$90,497	$0	15	4,747,500	0	4,747,500	$30,165.58	3.0	$511,150	6.6

Southern Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.045	$0.0121
Natural Gas	$0.014	$0.0064
Discount Rate	7.38%	

Financial & Economic Analysis - Energy-efficiency Measures

Measure Name: Heat Treating and Annealing Oven Insulation Upgrade

	Measure Description	Baseline Energy Use (MJ/yr.)		Upgrade Energy Use (MJ/yr.)		Measure Capital & Installation Cost F = full I=Incremental		Incremental O & M ($/yr)	Measure Life (yrs.)	Annual Energy Svg (MJ/yr.)		Participant Impact			Measure Total Resource Cost	B/C Ratio
		Natural Gas	Electricity	Natural Gas	Electricity					Natural Gas	Electricity	Annual Energy Svgs (MJ)	Annual Cost Svgs ($)	Simple Payback (yrs.)		
11	**Ceramic Fibre Insulation on 4000 MBTU Furnance Baseline Efficiency = 25% Upgrade Efficiency = 40%**	12,660,000	-	7,912,500	0	F	$90,497	$0	15	4,747,500	0	4,747,500	$30,165.58	3.0	$511,150	6.6

** *Measure TRC = Measure cost + chg in annual O&M +PV Electricity Avoided Cost/Supply + PV Natural Gas Avoided Cost/Supply*

** *Considerations such as incentives, program delivery costs occur in later stages of the analysis*

** *1KWh = 3.6 MJ*

Assumptions:

For process loads furnaces operate at 4,000 hours a year, 75% loaded.

A standard furnace capacity of 4 MMBtu/hr is used

Price and payback are from suppliers and literature as cited in the the Industrial Sector Report

Electricity use and savings are negligible

3 year payback is typical based on literature

Incremental operating and maintenance costs are negligible

25%	*efficiency of*	*Standard efficiency heat treating furnace*
40%	*efficiency of*	*efficiency heat treating furnace*

Vancouver Island	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.045	$0.0121
Natural Gas	$0.013	$0.0103
Discount Rate	6.87%	

Financial & Economic Analysis - Energy-efficiency Measures

Steam Trap Maintenance and Pipe Insulation

	Measure Description	Baseline Energy Use (MJ/yr.)		Upgrade Energy Use (MJ/yr.)		Measure Capital & Installation Cost F = full I=Incremental		Incremental O & M ($/yr)	Measure Life (yrs.)	Annual Energy Svg (MJ/yr.)		Participant Impact			Measure Total Resource Cost	B/C Ratio
		Natural Gas	Electricity	Natural Gas	Electricity					Natural Gas	Electricity	Annual Energy Svgs (MJ)	Annual Cost Svgs ($)	Simple Payback (yrs.)		
1	Process Steam Upgrade Bundle, Steam Traps, Insulation	200,000,000	-	190,000,000	0	F	$60,000	$40,000	10	10,000,000	0	10,000,000	$23,539.90	2.5	$573,819	2.7

Lower Mainland	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.045	$0.0121
Natural Gas	$0.013	$0.0064
Discount Rate	7.38%	

Financial & Economic Analysis - Energy-efficiency Measures

Measure Name: Steam Trap Maintenance and Pipe Insulation

	Measure Description	Baseline Energy Use (MJ/yr.)		Upgrade Energy Use (MJ/yr.)		Measure Capital & Installation Cost F = full I=Incremental		Incremental O & M ($/yr)	Measure Life (yrs.)	Annual Energy Svg (MJ/yr.)		Participant Impact			Measure Total Resource Cost	B/C Ratio
		Natural Gas	Electricity	Natural Gas	Electricity					Natural Gas	Electricity	Annual Energy Svgs (MJ)	Annual Cost Svgs ($)	Simple Payback (yrs.)		
1	Process Steam Upgrade Bundle, Steam Traps, Insulation	200,000,000	-	190,000,000	0	F	$60,000	$40,000	10	10,000,000	0	10,000,000	$23,539.90	2.5	$559,096	2.7

Northern Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.045	$0.0121
Natural Gas	$0.013	$0.0064
Discount Rate	7.38%	

Financial & Economic Analysis - Energy-efficiency Measures

Steam Trap Maintenance and Pipe Insulation

	Measure Description	Baseline Energy Use (MJ/yr.)		Upgrade Energy Use (MJ/yr.)		Measure Capital & Installation Cost F = full I=Incremental		Incremental O & M ($/yr)	Measure Life (yrs.)	Annual Energy Svg (MJ/yr.)		Participant Impact			Measure Total Resource Cost	B/C Ratio
		Natural Gas	Electricity	Natural Gas	Electricity					Natural Gas	Electricity	Annual Energy Svgs (MJ)	Annual Cost Svgs ($)	Simple Payback (yrs.)		
1	Process Steam Upgrade Bundle, Steam Traps, Insulation	200,000,000	-	190,000,000	0	F	$60,000	$40,000	10	10,000,000	0	10,000,000	$23,539.90	2.5	$559,096	2.7

Southern Interior	Marginal Supply Cost $/MJ	Customer Cost $/MJ
Electricity	$0.045	$0.0121
Natural Gas	$0.013	$0.0064
Discount Rate	7.38%	

Financial & Economic Analysis - Energy-efficiency Measures

Measure Name: Steam Trap Maintenance and Pipe Insulation

	Measure Description	Baseline Energy Use (MJ/yr.)		Upgrade Energy Use (MJ/yr.)		Measure Capital & Installation Cost F = full I=Incremental		Incremental O & M ($/yr)	Measure Life (yrs.)	Annual Energy Svg (MJ/yr.)		Participant Impact			Measure Total Resource Cost	B/C Ratio
		Natural Gas	Electricity	Natural Gas	Electricity					Natural Gas	Electricity	Annual Energy Svgs (MJ)	Annual Cost Svgs ($)	Simple Payback (yrs.)		
1	Process Steam Upgrade Bundle, Steam Traps, Insulation	200,000,000	-	190,000,000	0	F	$60,000	$40,000	10	10,000,000	0	10,000,000	$23,539.90	2.5	$559,096	2.7

** *Measure TRC = Measure cost + chg in annual O&M +PV Electricity Avoided Cost/Supply + PV Natural Gas Avoided Cost/Supply*

** *Considerations such as incentives, program delivery costs occur in later stages of the analysis*

** *1KWh = 3.6 MJ*

Assumptions:

1 year payback based on $6/GJ gas - from sector report

Standard size based on average annual gas use 200,000 GJ.

Budget of 50,000 annually to maintain the steam traps

Appendix D Background-Chapter 6: Economic Potential Forecast

Economic Case - Output for 2015

Total Industrial Sector			Lower Mainland		Northern Interior		Southern Interior		Vancouver Island		Total	
	#	Natural Gas Energy Conversion Device	Gas Sales (GJ)	Useful Heat (GJ)	Gas Sales (GJ)	Useful Heat (GJ)	Gas Sales (GJ)	Useful Heat (GJ)	Gas Sales (GJ)	Useful Heat (GJ)	Gas Sales (GJ)	Useful Heat (GJ)
Comfort Heat			**1,757,749**	**1,246,736**	**675,664**	**515,546**	**444,698**	**338,828**	**129,634**	**90,447**	**3,007,745**	**2,191,557**
Boilers	1	Standard Efficiency Boiler	0	0	0	0	0	0	0	0	0	0
	2	Near Condensing Boilers	55,663	37,628	30,998	24,290	66,425	49,225	1,242	832	154,329	111,975
	3	Condensing Boiler	27,621	20,839	12,053	10,155	47,101	38,948	644	484	87,419	70,425
Air Heating	4	Standard Efficiency Air Handling Units and Unit Heaters	0	0	0	0	0	0	0	0	0	0
	5	High-efficiency Air Handling Units and Unit heaters (Condensing)	695,505	465,797	302,706	217,584	158,030	112,900	58,553	38,065	1,214,794	834,347
	6	Radiant Tube Heating	978,959	722,472	329,907	263,517	173,142	137,756	69,194	51,065	1,551,203	1,174,810
			0	0	0	0	0	0	0	0	0	0
			0	0	0	0	0	0	0	0	0	0
			0	0	0	0	0	0	0	0	0	0
Process Heating			**9,994,079**	**7,910,176**	**7,245,989**	**5,890,265**	**3,959,896**	**3,032,664**	**502,256**	**364,680**	**21,702,219**	**17,197,785**
Boilers	1	Standard Efficiency Boiler	0	0	0	0	0	0	0	0	0	0
	2	Near Condensing Boiler	1,868,901	1,377,333	1,844,869	1,471,404	899,651	660,716	97,673	66,628	4,711,094	3,576,081
	3	Condensing Boiler	2,995,160	2,637,416	470,523	398,359	500,472	402,551	84,563	68,697	4,050,718	3,507,023
Water Heaters	4	Tank-type Water Heating	121,940	63,784	5,449	2,872	12,951	6,851	16,312	8,677	156,652	82,184
	5	Instantanious Water Heater	46,339	32,980	2,575	1,834	6,245	4,450	10,981	7,829	66,140	47,093
	6	Direct-fired Water Heating	514,329	387,025	71,305	54,191	70,233	53,149	26,915	20,456	682,781	514,821
Ovens	7	Standard Efficiency Oven	75,021	53,593	1,477	1,049	9,170	6,534	490	348	86,158	61,525
	8	Efficient Oven	370,784	308,137	7,866	6,542	47,882	39,868	2,882	2,392	429,414	356,940
Heat Treating	9	Standard Efficiency Heat Treating Furnace	63,485	29,773	17,842	8,383	3,374	1,569	892	373	85,593	40,097
	10	Heat Treating Furnace with Sequential Firing, High-velocity Burners	379,126	225,389	93,074	55,371	18,992	11,250	5,348	3,047	496,540	295,056
Lumber Kiln	11	Standard Efficiency Kiln	120,925	76,485	238,000	150,535	105,068	66,456	20,449	12,934	484,442	306,409
	12	High-efficiency Kiln	329,585	291,683	648,680	574,082	286,368	253,436	55,733	49,324	1,320,366	1,168,524
Veneer Dryers	13	Standard Efficiency Veneer Dryer	18,881	9,960	37,161	19,603	16,405	8,654	3,193	1,684	75,641	39,901
	14	Advanced Veneer Dryer	67,308	47,789	132,474	94,056	58,482	41,522	11,382	8,081	269,646	191,449
Paper	15	Direct-fired Paper Drying	207,843	182,382	966,742	848,316	215,932	189,481	2,310	2,027	1,392,827	1,222,206
Pulp Lime Kilns	16	Standard Efficiency Pulp Lime Kilns	217,693	170,889	1,492,071	1,171,276	332,684	261,157	0	0	2,042,449	1,603,322
	17	High-efficiency Pulp Lime Kilns	87,066	80,100	596,749	549,009	133,056	122,411	0	0	816,870	751,521
Cement Kilns	18	Standard Efficiency Cement Kilns	410,717	299,413	31,797	23,180	23,336	17,012	0	0	465,850	339,604
	19	High-efficiency Cement Kilns	62,776	51,162	3,011	2,454	14,928	12,167	0	0	80,715	65,783
Ore Drying	20	Standard Efficiency Ore Dryer	0	0	106,927	72,122	0	0	0	0	106,927	72,122
	21	High-efficiency Ore Dryer	0	0	4,808	3,734	0	0	0	0	4,808	3,734
Coal Drying	22	Standard Efficiency Coal Dryer	0	0	0	0	1,122,808	812,913	0	0	1,122,808	812,913
	23	High-efficiency Coal Dryer (with centrifuge)	0	0	0	0	54,194	42,082	0	0	54,194	42,082
Misc	24	Miscellaneous Standard Equipment	2,340	1,605	101	69	620	426	1,653	1,134	4,714	3,234
	25	Miscellaneous Efficient Equipment	2,671	2,193	115	94	708	581	1,887	1,549	5,381	4,418
Laundry	26	Direct-fired Gas Laundry Dryers	25,480	13,199	2,093	1,084	865	448	27,397	14,192	55,835	28,922
Direct-fired	27	Direct-fired Heating	1,245,495	807,673	250,454	160,819	23,306	14,819	104,800	67,911	1,624,056	1,051,222
Direct Consumption	28	Gas Consumed in Process	760,214	760,214	219,828	219,828	2,162	2,162	27,397	27,397	1,009,601	1,009,601
			0	0	0	0	0	0	0	0	0	0
			0	0	0	0	0	0	0	0	0	0
Total for Total Industrial Sector			**11,751,828**	**9,156,912**	**7,921,653**	**6,405,811**	**4,404,594**	**3,371,492**	**631,889**	**455,127**	**24,709,965**	**19,389,342**

Economic Case - Output for 2020

Total Industrial Sector			Lower Mainland		Northern Interior		Southern Interior		Vancouver Island		Total	
	#	Natural Gas Energy Conversion Device	Gas Sales (GJ)	Useful Heat (GJ)	Gas Sales (GJ)	Useful Heat (GJ)	Gas Sales (GJ)	Useful Heat (GJ)	Gas Sales (GJ)	Useful Heat (GJ)	Gas Sales (GJ)	Useful Heat (GJ)
Comfort Heat			**1,727,362**	**1,260,063**	**670,333**	**525,359**	**439,295**	**343,855**	**125,295**	**89,978**	**2,962,286**	**2,219,254**
Boilers	1	Standard Efficiency Boiler	0	0	0	0	0	0	0	0	0	0
	2	Near Condensing Boilers	55,321	38,591	30,823	24,855	66,099	50,442	1,232	852	153,475	114,740
	3	Condensing Boiler	28,405	21,958	12,373	10,656	47,560	40,211	659	508	88,998	73,333
Air Heating	4	Standard Efficiency Air Handling Units and Unit Heaters	0	0	0	0	0	0	0	0	0	0
	5	High-efficiency Air Handling Units and Unit heaters (Condensing)	688,150	477,166	299,647	222,269	155,094	114,394	56,323	37,905	1,199,214	851,733
	6	Radiant Tube Heating	955,487	722,348	327,491	267,579	170,541	138,808	67,080	50,713	1,520,599	1,179,447
			0	0	0	0	0	0	0	0	0	0
			0	0	0	0	0	0	0	0	0	0
			0	0	0	0	0	0	0	0	0	0
Process Heating			**9,950,884**	**8,016,077**	**7,263,809**	**6,010,383**	**3,972,580**	**3,095,685**	**498,461**	**371,460**	**21,685,734**	**17,493,604**
Boilers	1	Standard Efficiency Boiler	0	0	0	0	0	0	0	0	0	0
	2	Near Condensing Boiler	1,867,368	1,423,450	1,867,533	1,541,248	902,072	687,061	95,889	67,883	4,732,862	3,719,642
	3	Condensing Boiler	3,009,088	2,672,178	459,563	398,543	502,336	413,821	85,606	70,650	4,056,593	3,555,192
Water Heaters	4	Tank-type Water Heating	112,961	59,307	4,998	2,643	12,055	6,401	14,803	7,903	144,817	76,253
	5	Instantanious Water Heater	54,776	38,936	2,907	2,069	7,152	5,094	11,788	8,404	76,623	54,503
	6	Direct-fired Water Heating	514,671	399,481	70,976	55,627	70,133	54,738	27,006	21,166	682,786	531,012
Ovens	7	Standard Efficiency Oven	52,604	38,001	1,043	749	6,484	4,673	340	244	60,470	43,667
	8	Efficient Oven	389,514	325,642	8,243	6,897	50,066	41,932	2,870	2,396	450,694	376,867
Heat Treating	9	Standard Efficiency Heat Treating Furnace	42,552	20,800	11,801	5,781	2,253	1,091	635	276	57,241	27,947
	10	Heat Treating Furnace with Sequential Firing, High-velocity Burners	383,098	233,500	94,967	57,922	19,265	11,701	5,366	3,139	502,695	306,262
Lumber Kiln	11	Standard Efficiency Kiln	83,997	54,094	165,320	106,466	72,983	47,001	14,204	9,147	336,504	216,709
	12	High-efficiency Kiln	369,442	326,956	727,125	643,505	320,999	284,084	62,473	55,289	1,480,038	1,309,834
Veneer Dryers	13	Standard Efficiency Veneer Dryer	12,705	6,784	25,005	13,353	11,039	5,895	2,148	1,147	50,897	27,179
	14	Advanced Veneer Dryer	73,692	52,322	145,039	102,978	64,029	45,461	12,461	8,848	295,222	209,608
Paper	15	Direct-fired Paper Drying	209,583	183,268	974,338	856,443	217,666	191,329	2,681	2,357	1,404,269	1,233,397
Pulp Lime Kilns	16	Standard Efficiency Pulp Lime Kilns	216,680	163,769	1,429,902	1,122,473	318,822	250,276	0	0	1,965,405	1,536,517
	17	High-efficiency Pulp Lime Kilns	96,394	88,683	660,686	607,831	147,312	135,527	0	0	904,392	832,041
Cement Kilns	18	Standard Efficiency Cement Kilns	374,313	272,874	28,979	21,126	21,267	15,504	0	0	424,559	309,504
	19	High-efficiency Cement Kilns	78,208	63,739	4,296	3,501	15,248	12,427	0	0	97,752	79,668
Ore Drying	20	Standard Efficiency Ore Dryer	0	0	102,471	69,117	0	0	0	0	102,471	69,117
	21	High-efficiency Ore Dryer	0	0	9,616	7,467	0	0	0	0	9,616	7,467
Coal Drying	22	Standard Efficiency Coal Dryer	0	0	0	0	1,076,025	779,042	0	0	1,076,025	779,042
	23	High-efficiency Coal Dryer (with centrifuge)	0	0	0	0	108,388	84,164	0	0	108,388	84,164
Misc	24	Miscellaneous Standard Equipment	2,068	1,435	89	62	548	381	1,461	1,014	4,167	2,892
	25	Miscellaneous Efficient Equipment	2,697	2,225	116	96	715	590	1,906	1,572	5,434	4,483
Laundry	26	Direct-fired Gas Laundry Dryers	24,231	12,988	1,990	1,067	822	441	26,054	13,965	53,098	28,461
Direct-fired	27	Direct-fired Heating	1,221,424	816,826	247,233	163,848	22,843	14,997	104,715	70,006	1,596,215	1,065,677
Direct Consumption	28	Gas Consumed in Process	758,818	758,818	219,572	219,572	2,056	2,056	26,054	26,054	1,006,500	1,006,500
			0	0	0	0	0	0	0	0	0	0
			0	0	0	0	0	0	0	0	0	0
Total for Total Industrial Sector			**11,678,246**	**9,276,140**	**7,934,142**	**6,535,741**	**4,411,875**	**3,439,540**	**623,757**	**461,437**	**24,648,020**	**19,712,858**

Economic Case - Output for 2025

Total Industrial Sector			Lower Mainland		Northern Interior		Southern Interior		Vancouver Island		Total	
	#	Natural Gas Energy Conversion Device	Gas Sales (GJ)	Useful Heat (GJ)	Gas Sales (GJ)	Useful Heat (GJ)	Gas Sales (GJ)	Useful Heat (GJ)	Gas Sales (GJ)	Useful Heat (GJ)	Gas Sales (GJ)	Useful Heat (GJ)
Comfort Heat			**1,698,668**	**1,273,490**	**665,251**	**535,140**	**434,131**	**348,851**	**121,154**	**89,472**	**2,919,203**	**2,246,953**
Boilers	1	Standard Efficiency Boiler	0	0	0	0	0	0	0	0	0	0
	2	Near Condensing Boilers	54,968	39,546	30,643	25,415	65,768	51,657	1,222	872	152,602	117,490
	3	Condensing Boiler	29,166	23,088	12,682	11,160	48,007	41,481	674	532	90,530	76,261
Air Heating	4	Standard Efficiency Air Handling Units and Unit Heaters	0	0	0	0	0	0	0	0	0	0
	5	High-efficiency Air Handling Units and Unit heaters (Condensing)	681,335	488,560	296,807	226,979	152,347	115,894	54,229	37,737	1,184,718	869,170
	6	Radiant Tube Heating	933,199	722,296	325,119	271,585	168,008	139,819	65,028	50,332	1,491,354	1,184,031
			0	0	0	0	0	0	0	0	0	0
			0	0	0	0	0	0	0	0	0	0
			0	0	0	0	0	0	0	0	0	0
Process Heating			**9,896,722**	**8,117,996**	**7,281,392**	**6,128,811**	**3,985,185**	**3,157,928**	**493,787**	**378,049**	**21,657,086**	**17,782,784**
Boilers	1	Standard Efficiency Boiler	0	0	0	0	0	0	0	0	0	0
	2	Near Condensing Boiler	1,864,592	1,470,021	1,889,692	1,612,471	904,425	713,754	94,183	69,130	4,752,892	3,865,376
	3	Condensing Boiler	3,019,253	2,703,801	447,902	397,445	503,729	424,654	85,453	72,506	4,056,338	3,598,406
Water Heaters	4	Tank-type Water Heating	104,075	54,844	4,560	2,420	11,159	5,946	13,364	7,160	133,157	70,370
	5	Instantanious Water Heater	63,182	44,871	3,231	2,299	8,064	5,742	12,558	8,951	87,035	61,863
	6	Direct-fired Water Heating	515,026	411,963	70,667	57,064	70,043	56,330	27,094	21,879	682,830	547,236
Ovens	7	Standard Efficiency Oven	30,806	22,516	616	448	3,858	2,814	204	148	35,484	25,926
	8	Efficient Oven	407,838	342,986	8,617	7,252	52,217	43,990	2,851	2,395	471,524	396,623
Heat Treating	9	Standard Efficiency Heat Treating Furnace	23,417	11,907	6,296	3,209	1,230	618	397	177	31,340	15,912
	10	Heat Treating Furnace with Sequential Firing, High-velocity Burners	385,591	240,807	96,393	60,238	19,455	12,109	5,368	3,222	506,807	316,376
Lumber Kiln	11	Standard Efficiency Kiln	47,751	31,301	93,982	61,605	41,490	27,196	8,075	5,293	191,298	125,396
	12	High-efficiency Kiln	408,924	361,898	804,832	712,277	355,304	314,444	69,150	61,197	1,638,210	1,449,816
Veneer Dryers	13	Standard Efficiency Veneer Dryer	6,637	3,587	13,062	7,060	5,766	3,117	1,122	607	26,587	14,370
	14	Advanced Veneer Dryer	80,014	56,810	157,482	111,812	69,522	49,361	13,531	9,607	320,549	227,590
Paper	15	Direct-fired Paper Drying	210,663	184,190	981,899	864,562	219,388	193,171	3,051	2,686	1,415,001	1,244,610
Pulp Lime Kilns	16	Standard Efficiency Pulp Lime Kilns	207,439	156,648	1,367,732	1,073,670	304,961	239,394	0	0	1,880,132	1,469,712
	17	High-efficiency Pulp Lime Kilns	105,723	97,265	724,623	666,653	161,568	148,642	0	0	991,914	912,561
Cement Kilns	18	Standard Efficiency Cement Kilns	340,491	248,218	26,360	19,217	19,346	14,103	0	0	386,197	281,538
	19	High-efficiency Cement Kilns	91,977	74,961	5,448	4,440	15,501	12,633	0	0	112,926	92,035
Ore Drying	20	Standard Efficiency Ore Dryer	0	0	98,016	66,112	0	0	0	0	98,016	66,112
	21	High-efficiency Ore Dryer	0	0	14,424	11,201	0	0	0	0	14,424	11,201
Coal Drying	22	Standard Efficiency Coal Dryer	0	0	0	0	1,029,241	745,171	0	0	1,029,241	745,171
	23	High-efficiency Coal Dryer (with centrifuge)	0	0	0	0	162,583	126,245	0	0	162,583	126,245
Misc	24	Miscellaneous Standard Equipment	1,817	1,276	78	55	482	338	1,284	901	3,661	2,570
	25	Miscellaneous Efficient Equipment	2,714	2,250	117	97	720	597	1,918	1,590	5,469	4,534
Laundry	26	Direct-fired Gas Laundry Dryers	23,044	12,766	1,893	1,049	782	433	24,777	13,727	50,496	27,975
Direct-fired	27	Direct-fired Heating	1,198,257	825,620	244,141	166,828	22,398	15,168	104,630	72,095	1,569,426	1,079,711
Direct Consumption	28	Gas Consumed in Process	757,490	757,490	219,328	219,328	1,955	1,955	24,777	24,777	1,003,551	1,003,551
			0	0	0	0	0	0	0	0	0	0
			0	0	0	0	0	0	0	0	0	0
Total for Total Industrial Sector			**11,595,390**	**9,391,486**	**7,946,643**	**6,663,950**	**4,419,315**	**3,506,779**	**614,941**	**467,521**	**24,576,289**	**20,029,736**

Economic Case - Output for 2030

Total Industrial Sector			Lower Mainland		Northern Interior		Southern Interior		Vancouver Island		Total	
	#	Natural Gas Energy Conversion Device	Gas Sales (GJ)	Useful Heat (GJ)	Gas Sales (GJ)	Useful Heat (GJ)	Gas Sales (GJ)	Useful Heat (GJ)	Gas Sales (GJ)	Useful Heat (GJ)	Gas Sales (GJ)	Useful Heat (GJ)
Comfort Heat			**1,671,536**	**1,287,017**	**660,398**	**544,890**	**429,189**	**353,822**	**117,199**	**88,936**	**2,878,321**	**2,274,665**
Boilers	1	Standard Efficiency Boiler	0	0	0	0	0	0	0	0	0	0
	2	Near Condensing Boilers	54,606	40,490	30,459	25,971	65,432	52,869	1,212	891	151,709	120,222
	3	Condensing Boiler	29,904	24,228	12,982	11,666	48,442	42,757	689	556	92,016	79,208
Air Heating	4	Standard Efficiency Air Handling Units and Unit Heaters	0	0	0	0	0	0	0	0	0	0
	5	High-efficiency Air Handling Units and Unit heaters (Condensing)	675,009	499,981	294,166	231,715	149,772	117,401	52,260	37,563	1,171,206	886,660
	6	Radiant Tube Heating	912,017	722,317	322,792	275,537	165,543	140,795	63,038	49,926	1,463,389	1,188,575
			0	0	0	0	0	0	0	0	0	0
			0	0	0	0	0	0	0	0	0	0
			0	0	0	0	0	0	0	0	0	0
Process Heating			**9,841,405**	**8,215,748**	**7,298,672**	**6,245,536**	**3,997,660**	**3,219,369**	**490,432**	**384,448**	**21,628,168**	**18,065,101**
Boilers	1	Standard Efficiency Boiler	0	0	0	0	0	0	0	0	0	0
	2	Near Condensing Boiler	1,861,815	1,517,034	1,911,358	1,685,064	906,703	740,788	92,549	70,371	4,772,425	4,013,256
	3	Condensing Boiler	3,025,394	2,732,001	435,531	395,035	504,644	435,032	86,323	74,264	4,051,893	3,636,332
Water Heaters	4	Tank-type Water Heating	95,273	50,391	4,134	2,201	10,261	5,488	11,989	6,446	121,657	64,526
	5	Instantanious Water Heater	71,565	50,790	3,548	2,524	8,983	6,395	13,292	9,474	97,388	69,182
	6	Direct-fired Water Heating	515,383	424,466	70,376	58,500	69,960	57,925	27,180	22,593	682,899	563,484
Ovens	7	Standard Efficiency Oven	9,587	7,122	197	145	1,291	957	81	59	11,156	8,284
	8	Efficient Oven	425,785	360,188	8,987	7,608	54,337	46,043	2,827	2,389	491,936	416,229
Heat Treating	9	Standard Efficiency Heat Treating Furnace	5,972	3,143	1,289	682	298	152	179	79	7,737	4,056
	10	Heat Treating Furnace with Sequential Firing, High-velocity Burners	386,762	247,343	97,401	62,329	19,570	12,476	5,355	3,296	509,089	325,443
Lumber Kiln	11	Standard Efficiency Kiln	12,153	8,106	23,919	15,954	10,559	7,043	2,055	1,371	48,686	32,474
	12	High-efficiency Kiln	448,031	396,507	881,801	780,394	389,283	344,515	75,763	67,050	1,794,877	1,588,466
Veneer Dryers	13	Standard Efficiency Veneer Dryer	673	368	1,325	725	585	320	114	62	2,697	1,475
	14	Advanced Veneer Dryer	86,274	61,255	169,802	120,560	74,961	53,223	14,589	10,358	345,627	245,395
Paper	15	Direct-fired Paper Drying	211,782	185,147	989,425	872,673	221,096	195,007	3,418	3,015	1,425,722	1,255,842
Pulp Lime Kilns	16	Standard Efficiency Pulp Lime Kilns	198,176	149,528	1,305,562	1,024,866	291,099	228,513	0	0	1,794,837	1,402,907
	17	High-efficiency Pulp Lime Kilns	115,051	105,847	788,561	725,476	175,824	161,758	0	0	1,079,436	993,081
Cement Kilns	18	Standard Efficiency Cement Kilns	309,085	225,323	23,929	17,444	17,561	12,802	0	0	350,576	255,570
	19	High-efficiency Cement Kilns	104,208	84,929	6,477	5,279	15,692	12,789	0	0	126,377	102,998
Ore Drying	20	Standard Efficiency Ore Dryer	0	0	93,561	63,107	0	0	0	0	93,561	63,107
	21	High-efficiency Ore Dryer	0	0	19,233	14,934	0	0	0	0	19,233	14,934
Coal Drying	22	Standard Efficiency Coal Dryer	0	0	0	0	982,457	711,299	0	0	982,457	711,299
	23	High-efficiency Coal Dryer (with centrifuge)	0	0	0	0	216,777	168,327	0	0	216,777	168,327
Misc	24	Miscellaneous Standard Equipment	1,586	1,126	68	48	420	299	1,121	796	3,195	2,269
	25	Miscellaneous Efficient Equipment	2,724	2,269	117	98	722	602	1,924	1,603	5,487	4,571
Laundry	26	Direct-fired Gas Laundry Dryers	21,914	12,535	1,800	1,030	744	425	23,563	13,478	48,021	27,468
Direct-fired	27	Direct-fired Heating	1,175,985	834,103	241,174	169,765	21,972	15,334	104,546	74,178	1,543,677	1,093,381
Direct Consumption	28	Gas Consumed in Process	756,228	756,228	219,096	219,096	1,859	1,859	23,563	23,563	1,000,746	1,000,746
			0	0	0	0	0	0	0	0	0	0
			0	0	0	0	0	0	0	0	0	0
Total for Total Industrial Sector			**11,512,940**	**9,502,764**	**7,959,069**	**6,790,426**	**4,426,850**	**3,573,191**	**607,630**	**473,384**	**24,506,489**	**20,339,766**

Economic Case Sub Sector Forecast Consumption and Market Share by Technology

ALL SERVICE AREAS

AGRICULTURE

			2015				2020				2025				2030			
			Annual Sales		Annual Useful Heat		Annual Sales		Annual Useful Heat		Annual Sales		Annual Useful Heat		Annual Sales		Annual Useful Heat	
			Market Share	Total Sales	Overall Efficiency	Total Useful Heat	Market Share	Total Sales	Overall Efficiency	Total Useful Heat	Market Share	Total Sales	Overall Efficiency	Total Useful Heat	Market Share	Total Sales	Overall Efficiency	Total Useful Heat
END USE		TECHNOLOGY	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)
COMFORT HEATING																		
Boilers	1	Standard Efficiency Boiler	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	2	Near Condensing Boilers	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	3	Condensing Boiler	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
Air Heating	4	Standard Efficiency Air Handling Units and Unit Heaters	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	5	High-efficiency Air Handling Units and Unit heaters (Condensing)	11%	315,944	70%	222,208	12%	322,796	73%	234,429	12%	329,312	75%	246,719	12%	335,512	77%	259,068
	6	Radiant Tube Heating	9%	241,725	74%	179,740	9%	249,487	76%	189,961	9%	256,839	78%	200,142	9%	263,788	80%	210,269
END USE		TECHNOLOGY																
PROCESS HEATING																		
Boilers	1	Standard Efficiency Boiler	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	2	Near Condensing Boiler	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	3	Condensing Boiler	78%	2,156,602	93%	2,001,822	78%	2,170,467	93%	2,014,193	78%	2,179,298	93%	2,022,909	77%	2,185,044	93%	2,027,721
Water Heaters	4	Tank-type Water Heating	1%	39,845	50%	19,947	1%	36,825	50%	18,505	1%	33,852	50%	17,074	1%	30,921	51%	15,654
	5	Instantaneous Water Heater	0%	2,816	69%	1,943	0%	5,600	69%	3,864	0%	8,357	69%	5,767	0%	11,091	69%	7,653
	6	Direct-fired Water Heating	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
Ovens	7	Standard Efficiency Oven	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	8	Efficient Oven	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
Heat Treating	9	Standard Efficiency Heat Treating Furnace	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	10	Heat Treating Furnace with Sequential Firing, High-velocity Burners	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
Lumber Kiln	11	Standard Efficiency Kiln	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	12	High-efficiency Kiln	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
Veneer Dryers	13	Standard Efficiency Veneer Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	14	Advanced Veneer Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
Paper	15	Direct-fired Paper Drying	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
Pulp Lime Kilns	16	Standard Efficiency Pulp Lime Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	17	High-efficiency Pulp Lime Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
Cement Kilns	18	Standard Efficiency Cement Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	19	High-efficiency Cement Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
Ore Drying	20	Standard Efficiency Ore Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	21	High-efficiency Ore Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
Coal Drying	22	Standard Efficiency Coal Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	23	High-efficiency Coal Dryer (with centrifuge)	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
Miscellaneous	24	Miscellaneous Standard Equipment	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	25	Miscellaneous Efficient Equipment	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
Laundry	26	Direct-fired Gas Laundry Dryers	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
Direct-fired	27	Direct-fired Heating	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
Direct Consumption	28	Gas Consumed in Process	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
Total			**100%**	**2,756,931**		**2,425,660**	**100%**	**2,785,175**		**2,460,952**	**100%**	**2,807,658**		**2,492,611**	**100%**	**2,826,356**		**2,520,364**

Economic Case Sub Sector Forecast Consumption and Market Share by Technology

ALL SERVICE AREAS

CHEMICAL

				2015				2020				2025				2030			
				Annual Sales		Annual Useful Heat		Annual Sales		Annual Useful Heat		Annual Sales		Annual Useful Heat		Annual Sales		Annual Useful Heat	
				Market Share	Total Sales	Overall Efficiency	Total Useful Heat	Market Share	Total Sales	Overall Efficiency	Total Useful Heat	Market Share	Total Sales	Overall Efficiency	Total Useful Heat	Market Share	Total Sales	Overall Efficiency	Total Useful Heat
	END USE		TECHNOLOGY	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)
COMFORT HEATING	Boilers	1	Standard Efficiency Boiler	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		2	Near Condensing Boilers	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		3	Condensing Boiler	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Air Heating	4	Standard Efficiency Air Handling Units and Unit Heaters	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		5	High-efficiency Air Handling Units and Unit heaters (Condensing)	2%	58,813	67%	39,534	2%	58,896	70%	40,938	2%	58,991	72%	42,355	2%	59,097	74%	43,784
		6	Radiant Tube Heating	4%	124,618	78%	97,536	4%	124,794	80%	99,886	4%	124,932	82%	102,214	4%	125,036	84%	104,519
	END USE		TECHNOLOGY																
PROCESS HEATING	Boilers	1	Standard Efficiency Boiler	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		2	Near Condensing Boiler	26%	777,001	79%	614,785	26%	772,248	82%	632,169	25%	767,588	85%	649,608	25%	763,007	87%	667,095
		3	Condensing Boiler	7%	209,920	83%	174,331	7%	213,764	85%	182,338	7%	217,495	88%	190,428	7%	221,115	90%	198,594
	Water Heaters	4	Tank-type Water Heating	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		5	Instantaneous Water Heater	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		6	Direct-fired Water Heating	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Ovens	7	Standard Efficiency Oven	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		8	Efficient Oven	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Heat Treating	9	Standard Efficiency Heat Treating Furnace	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		10	Heat Treating Furnace with Sequential Firing, High-velocity Burners	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Lumber Kiln	11	Standard Efficiency Kiln	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		12	High-efficiency Kiln	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Veneer Dryers	13	Standard Efficiency Veneer Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		14	Advanced Veneer Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Paper	15	Direct-fired Paper Drying	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Pulp Lime Kilns	16	Standard Efficiency Pulp Lime Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		17	High-efficiency Pulp Lime Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Cement Kilns	18	Standard Efficiency Cement Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		19	High-efficiency Cement Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Ore Drying	20	Standard Efficiency Ore Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		21	High-efficiency Ore Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Coal Drying	22	Standard Efficiency Coal Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		23	High-efficiency Coal Dryer (with centrifuge)	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Miscellaneous	24	Miscellaneous Standard Equipment	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		25	Miscellaneous Efficient Equipment	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Laundry	26	Direct-fired Gas Laundry Dryers	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Direct-fired	27	Direct-fired Heating	30%	895,425	66%	590,085	30%	900,088	68%	611,160	30%	904,484	70%	632,234	30%	908,635	72%	653,309
	Direct Consumption	28	Gas Consumed in Process	31%	946,323	100%	946,323	31%	946,323	100%	946,323	31%	946,323	100%	946,323	31%	946,323	100%	946,323
	Total			**100%**	**3,012,100**		**2,462,595**	**100%**	**3,016,113**		**2,512,814**	**100%**	**3,019,814**		**2,563,162**	**100%**	**3,023,213**		**2,613,624**

Economic Case Sub Sector Forecast Consumption and Market Share by Technology

ALL SERVICE AREAS

FABRICATED METAL

				2015				2020				2025				2030			
				Annual Sales		Annual Useful Heat		Annual Sales		Annual Useful Heat		Annual Sales		Annual Useful Heat		Annual Sales		Annual Useful Heat	
				Market Share	Total Sales	Overall Efficiency	Total Useful Heat	Market Share	Total Sales	Overall Efficiency	Total Useful Heat	Market Share	Total Sales	Overall Efficiency	Total Useful Heat	Market Share	Total Sales	Overall Efficiency	Total Useful Heat
	END USE		TECHNOLOGY	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)
COMFORT HEATING	Boilers	1	Standard Efficiency Boiler	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		2	Near Condensing Boilers	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		3	Condensing Boiler	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Air Heating	4	Standard Efficiency Air Handling Units and Unit Heaters	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		5	High-efficiency Air Handling Units and Unit heaters (Condensing)	10%	119,590	66%	78,641	10%	113,319	68%	77,109	10%	107,422	70%	75,555	10%	101,872	73%	73,982
		6	Radiant Tube Heating	20%	233,224	75%	173,918	20%	221,247	76%	168,969	20%	209,873	78%	164,061	20%	199,073	80%	159,202

	END USE		TECHNOLOGY	Market Share 2015 (%)	Total Sales 2015 (GJ)	Overall Efficiency 2015 (%)	Total Useful Heat 2015 (GJ)	Market Share 2020 (%)	Total Sales 2020 (GJ)	Overall Efficiency 2020 (%)	Total Useful Heat 2020 (GJ)	Market Share 2025 (%)	Total Sales 2025 (GJ)	Overall Efficiency 2025 (%)	Total Useful Heat 2025 (GJ)	Market Share 2030 (%)	Total Sales 2030 (GJ)	Overall Efficiency 2030 (%)	Total Useful Heat 2030 (GJ)
PROCESS HEATING	Boilers	1	Standard Efficiency Boiler	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		2	Near Condensing Boiler	5%	57,768	81%	46,636	5%	54,805	83%	45,708	5%	53,287	84%	44,761	5%	51,772	85%	43,799
		3	Condensing Boiler	1%	13,274	71%	9,465	1%	12,884	74%	9,482	1%	12,496	76%	9,485	1%	12,112	78%	9,472
	Water Heaters	4	Tank-type Water Heating	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		5	Instantaneous Water Heater	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		6	Direct-fired Water Heating	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Ovens	7	Standard Efficiency Oven	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		8	Efficient Oven	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Heat Treating	9	Standard Efficiency Heat Treating Furnace	7%	84,399	47%	39,668	5%	56,326	49%	27,600	3%	30,687	51%	15,650	1%	7,330	53%	3,885
		10	Heat Treating Furnace with Sequential Firing, High-velocity Burners	43%	488,833	60%	290,856	45%	495,055	61%	301,984	48%	499,245	63%	312,028	50%	501,617	64%	321,035
	Lumber Kiln	11	Standard Efficiency Kiln	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		12	High-efficiency Kiln	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Veneer Dryers	13	Standard Efficiency Veneer Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		14	Advanced Veneer Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Paper	15	Direct-fired Paper Drying	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Pulp Lime Kilns	16	Standard Efficiency Pulp Lime Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		17	High-efficiency Pulp Lime Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Cement Kilns	18	Standard Efficiency Cement Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		19	High-efficiency Cement Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Ore Drying	20	Standard Efficiency Ore Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		21	High-efficiency Ore Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Coal Drying	22	Standard Efficiency Coal Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		23	High-efficiency Coal Dryer (with centrifuge)	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Miscellaneous	24	Miscellaneous Standard Equipment	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		25	Miscellaneous Efficient Equipment	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Laundry	26	Direct-fired Gas Laundry Dryers	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Direct-fired	27	Direct-fired Heating	13%	147,933	56%	82,843	13%	140,683	58%	81,596	13%	133,788	60%	80,273	13%	127,231	62%	78,883
	Direct Consumption	28	Gas Consumed in Process	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Total			**100%**	**1,145,023**		**722,025**	**100%**	**1,094,319**		**712,448**	**100%**	**1,046,800**		**701,814**	**100%**	**1,001,009**		**690,259**

Economic Case Sub Sector Forecast Consumption and Market Share by Technology

ALL SERVICE AREAS

FOOD & BEVERAGE

				2015				2020				2025				2030			
				Annual Sales		Annual Useful Heat		Annual Sales		Annual Useful Heat		Annual Sales		Annual Useful Heat		Annual Sales		Annual Useful Heat	
				Market Share	Total Sales	Overall Efficiency	Total Useful Heat	Market Share	Total Sales	Overall Efficiency	Total Useful Heat	Market Share	Total Sales	Overall Efficiency	Total Useful Heat	Market Share	Total Sales	Overall Efficiency	Total Useful Heat
	END USE		TECHNOLOGY	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)
COMFORT HEATING	Boilers	1	Standard Efficiency Boiler	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		2	Near Condensing Boilers	2%	60,868	68%	41,561	2%	60,675	70%	42,741	2%	60,461	73%	43,911	2%	60,224	75%	45,069
		3	Condensing Boiler	1%	32,177	77%	24,689	1%	33,146	79%	26,046	1%	34,088	80%	27,418	1%	35,003	82%	28,803
	Air Heating	4	Standard Efficiency Air Handling Units and Unit Heaters	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		5	High-efficiency Air Handling Units and Unit heaters (Condensing)	3%	105,452	67%	70,913	3%	105,325	70%	73,240	3%	105,233	72%	75,586	3%	105,170	74%	77,949
		6	Radiant Tube Heating	4%	113,071	76%	86,073	4%	114,068	78%	88,884	4%	114,980	80%	91,664	4%	115,811	82%	94,411
	END USE		TECHNOLOGY																
PROCESS HEATING	Boilers	1	Standard Efficiency Boiler	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		2	Near Condensing Boiler	30%	917,601	68%	626,333	30%	920,651	71%	652,151	30%	923,517	73%	678,269	30%	926,197	76%	704,672
		3	Condensing Boiler	25%	758,663	77%	580,832	25%	768,405	79%	606,118	25%	777,560	81%	631,379	25%	786,130	84%	656,576
	Water Heaters	4	Tank-type Water Heating	3%	86,780	53%	46,237	3%	81,254	53%	43,450	2%	75,636	54%	40,593	2%	69,926	54%	37,664
		5	Instantaneous Water Heater	1%	43,297	71%	30,871	2%	49,801	71%	35,508	2%	56,397	71%	40,211	2%	63,085	71%	44,980
		6	Direct-fired Water Heating	18%	552,607	75%	415,889	18%	553,296	78%	429,524	18%	553,984	80%	443,193	18%	554,660	82%	456,885
	Ovens	7	Standard Efficiency Oven	2%	62,590	71%	44,126	1%	43,871	71%	31,280	1%	25,214	72%	18,179	0%	6,622	73%	4,827
		8	Efficient Oven	12%	355,898	83%	294,877	12%	374,807	83%	312,418	13%	393,684	84%	330,122	13%	412,527	84%	347,986
	Heat Treating	9	Standard Efficiency Heat Treating Furnace	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		10	Heat Treating Furnace with Sequential Firing, High-velocity Burners	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Lumber Kiln	11	Standard Efficiency Kiln	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		12	High-efficiency Kiln	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Veneer Dryers	13	Standard Efficiency Veneer Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		14	Advanced Veneer Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Paper	15	Direct-fired Paper Drying	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Pulp Lime Kilns	16	Standard Efficiency Pulp Lime Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		17	High-efficiency Pulp Lime Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Cement Kilns	18	Standard Efficiency Cement Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		19	High-efficiency Cement Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Ore Drying	20	Standard Efficiency Ore Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		21	High-efficiency Ore Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Coal Drying	22	Standard Efficiency Coal Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		23	High-efficiency Coal Dryer (with centrifuge)	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Miscellaneous	24	Miscellaneous Standard Equipment	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		25	Miscellaneous Efficient Equipment	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Laundry	26	Direct-fired Gas Laundry Dryers	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Direct-fired	27	Direct-fired Heating	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Direct Consumption	28	Gas Consumed in Process	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Total			**100%**	**3,089,004**		**2,262,401**	**100%**	**3,105,299**		**2,341,361**	**100%**	**3,120,753**		**2,420,524**	**100%**	**3,135,355**		**2,499,821**

Economic Case Sub Sector Forecast Consumption and Market Share by Technology

ALL SERVICE AREAS

MINING

				2015				2020				2025				2030			
				Annual Sales		Annual Useful Heat		Annual Sales		Annual Useful Heat		Annual Sales		Annual Useful Heat		Annual Sales		Annual Useful Heat	
				Market Share	Total Sales	Overall Efficiency	Total Useful Heat	Market Share	Total Sales	Overall Efficiency	Total Useful Heat	Market Share	Total Sales	Overall Efficiency	Total Useful Heat	Market Share	Total Sales	Overall Efficiency	Total Useful Heat
	END USE		TECHNOLOGY	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)	(%)	(GJ)
COMFORT HEATING	Boilers	1	Standard Efficiency Boiler	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		2	Near Condensing Boilers	3%	61,874	73%	45,408	3%	61,650	76%	46,599	3%	61,419	78%	47,790	3%	61,181	80%	48,979
		3	Condensing Boiler	2%	45,262	82%	37,335	2%	45,663	84%	38,512	2%	46,054	86%	39,695	2%	46,436	88%	40,884
	Air Heating	4	Standard Efficiency Air Handling Units and Unit Heaters	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		5	High-efficiency Air Handling Units and Unit heaters (Condensing)	1%	18,066	71%	12,797	1%	17,980	73%	13,147	1%	17,902	75%	13,500	1%	17,830	78%	13,855
		6	Radiant Tube Heating	1%	31,815	80%	25,381	1%	31,712	82%	25,871	1%	31,610	83%	26,357	1%	31,508	85%	26,839

	END USE		TECHNOLOGY																
PROCESS HEATING	Boilers	1	Standard Efficiency Boiler	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		2	Near Condensing Boiler	20%	435,595	69%	300,789	20%	433,066	72%	310,314	20%	430,576	74%	319,864	19%	428,115	77%	329,435
		3	Condensing Boiler	13%	283,453	77%	217,012	13%	285,470	79%	225,179	13%	287,456	81%	233,415	13%	289,409	84%	241,715
	Water Heaters	4	Tank-type Water Heating	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		5	Instantaneous Water Heater	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		6	Direct-fired Water Heating	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Ovens	7	Standard Efficiency Oven	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		8	Efficient Oven	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Heat Treating	9	Standard Efficiency Heat Treating Furnace	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		10	Heat Treating Furnace with Sequential Firing, High-velocity Burners	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Lumber Kiln	11	Standard Efficiency Kiln	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		12	High-efficiency Kiln	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Veneer Dryers	13	Standard Efficiency Veneer Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		14	Advanced Veneer Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Paper	15	Direct-fired Paper Drying	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Pulp Lime Kilns	16	Standard Efficiency Pulp Lime Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		17	High-efficiency Pulp Lime Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Cement Kilns	18	Standard Efficiency Cement Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		19	High-efficiency Cement Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Ore Drying	20	Standard Efficiency Ore Dryer	5%	106,927	67%	72,122	5%	102,471	67%	69,117	4%	98,016	67%	66,112	4%	93,561	67%	63,107
		21	High-efficiency Ore Dryer	0%	4,808	78%	3,734	0%	9,616	78%	7,467	1%	14,424	78%	11,201	1%	19,233	78%	14,934
	Coal Drying	22	Standard Efficiency Coal Dryer	52%	1,122,808	72%	812,913	49%	1,076,025	72%	779,042	47%	1,029,241	72%	745,171	45%	982,457	72%	711,299
		23	High-efficiency Coal Dryer (with centrifuge)	2%	54,194	78%	42,082	5%	108,388	78%	84,164	7%	162,583	78%	126,245	10%	216,777	78%	168,327
	Miscellaneous	24	Miscellaneous Standard Equipment	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		25	Miscellaneous Efficient Equipment	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Laundry	26	Direct-fired Gas Laundry Dryers	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Direct-fired	27	Direct-fired Heating	1%	11,228	56%	6,287	1%	11,228	58%	6,512	1%	11,228	60%	6,737	1%	11,228	62%	6,961
	Direct Consumption	28	Gas Consumed in Process	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Total			**100%**	**2,176,030**		**1,575,860**	**100%**	**2,183,270**		**1,605,923**	**100%**	**2,190,509**		**1,636,084**	**100%**	**2,197,734**		**1,666,333**

Economic Case Sub Sector Forecast Consumption and Market Share by Technology

ALL SERVICE AREAS

MISCELLANEOUS MANUFACTURING

	END USE		TECHNOLOGY	2015 Annual Sales Market Share (%)	2015 Annual Sales Total Sales (GJ)	2015 Annual Useful Heat Overall Efficiency (%)	2015 Annual Useful Heat Total Useful Heat (GJ)	2020 Annual Sales Market Share (%)	2020 Annual Sales Total Sales (GJ)	2020 Annual Useful Heat Overall Efficiency (%)	2020 Annual Useful Heat Total Useful Heat (GJ)	2025 Annual Sales Market Share (%)	2025 Annual Sales Total Sales (GJ)	2025 Annual Useful Heat Overall Efficiency (%)	2025 Annual Useful Heat Total Useful Heat (GJ)	2030 Annual Sales Market Share (%)	2030 Annual Sales Total Sales (GJ)	2030 Annual Useful Heat Overall Efficiency (%)	2030 Annual Useful Heat Total Useful Heat (GJ)	
COMFORT HEATING	Boilers	1	Standard Efficiency Boiler	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	COMFORT HEATING
		2	Near Condensing Boilers	2%	5,507	69%	3,827	2%	5,218	72%	3,739	2%	4,943	74%	3,650	2%	4,682	76%	3,561	
		3	Condensing Boiler	1%	2,376	78%	1,852	1%	2,313	80%	1,846	1%	2,249	82%	1,837	1%	2,185	84%	1,826	
	Air Heating	4	Standard Efficiency Air Handling Units and Unit Heaters	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	
		5	High-efficiency Air Handling Units and Unit heaters (Condensing)	5%	18,523	68%	12,542	5%	17,543	70%	12,280	6%	16,622	72%	12,016	6%	15,755	75%	11,750	
		6	Radiant Tube Heating	79%	266,574	74%	197,307	79%	250,821	76%	190,169	78%	236,085	78%	183,253	78%	222,293	79%	176,555	

	END USE		TECHNOLOGY	2015 Market Share (%)	2015 Total Sales (GJ)	2015 Overall Efficiency (%)	2015 Total Useful Heat (GJ)	2020 Market Share (%)	2020 Total Sales (GJ)	2020 Overall Efficiency (%)	2020 Total Useful Heat (GJ)	2025 Market Share (%)	2025 Total Sales (GJ)	2025 Overall Efficiency (%)	2025 Total Useful Heat (GJ)	2030 Market Share (%)	2030 Total Sales (GJ)	2030 Overall Efficiency (%)	2030 Total Useful Heat (GJ)	
PROCESS HEATING	Boilers	1	Standard Efficiency Boiler	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	PROCESS HEATING
		2	Near Condensing Boiler	2%	6,116	68%	4,173	2%	5,783	71%	4,095	2%	5,467	73%	4,014	2%	5,168	76%	3,931	
		3	Condensing Boiler	1%	1,788	77%	1,369	1%	1,772	79%	1,398	1%	1,751	81%	1,422	1%	1,726	84%	1,442	
	Water Heaters	4	Tank-type Water Heating	1%	4,045	53%	2,155	1%	3,602	53%	1,926	1%	3,189	54%	1,711	1%	2,803	54%	1,510	
		5	Instantaneous Water Heater	1%	4,617	71%	3,292	1%	4,698	71%	3,349	2%	4,763	71%	3,396	2%	4,815	71%	3,433	
		6	Direct-fired Water Heating	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	
	Ovens	7	Standard Efficiency Oven	0%	1,397	71%	992	0%	969	72%	696	0%	581	73%	422	0%	231	73%	169	
		8	Efficient Oven	2%	8,219	83%	6,821	3%	8,183	84%	6,833	3%	8,131	84%	6,830	3%	8,063	85%	6,813	
	Heat Treating	9	Standard Efficiency Heat Treating Furnace	0%	1,193	36%	430	0%	915	38%	348	0%	653	40%	261	0%	407	42%	171	
		10	Heat Treating Furnace with Sequential Firing, High-velocity Burners	2%	7,707	55%	4,200	2%	7,640	56%	4,278	3%	7,562	58%	4,348	3%	7,472	59%	4,409	
	Lumber Kiln	11	Standard Efficiency Kiln	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	
		12	High-efficiency Kiln	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	
	Veneer Dryers	13	Standard Efficiency Veneer Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	
		14	Advanced Veneer Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	
	Paper	15	Direct-fired Paper Drying	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	
	Pulp Lime Kilns	16	Standard Efficiency Pulp Lime Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	
		17	High-efficiency Pulp Lime Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	
	Cement Kilns	18	Standard Efficiency Cement Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	
		19	High-efficiency Cement Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	
	Ore Drying	20	Standard Efficiency Ore Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	
		21	High-efficiency Ore Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	
	Coal Drying	22	Standard Efficiency Coal Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	
		23	High-efficiency Coal Dryer (with centrifuge)	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	
	Miscellaneous	24	Miscellaneous Standard Equipment	1%	4,714	69%	3,234	1%	4,167	69%	2,892	1%	3,661	70%	2,570	1%	3,195	71%	2,269	
		25	Miscellaneous Efficient Equipment	2%	5,381	82%	4,418	2%	5,434	83%	4,483	2%	5,469	83%	4,534	2%	5,487	83%	4,571	
	Laundry	26	Direct-fired Gas Laundry Dryers	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	
	Direct-fired	27	Direct-fired Heating	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	
	Direct Consumption	28	Gas Consumed in Process	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	
	Total			**100%**	**338,156**		**246,611**	**100%**	**319,057**		**238,332**	**100%**	**301,127**		**230,265**	**100%**	**284,283**		**222,408**	

Economic Case Sub Sector Forecast Consumption and Market Share by Technology

ALL SERVICE AREAS

NON-METAL MANUFACTURING

	END USE		TECHNOLOGY	2015 Annual Sales Market Share (%)	2015 Annual Sales Total Sales (GJ)	2015 Annual Useful Heat Overall Efficiency (%)	2015 Annual Useful Heat Total Useful Heat (GJ)	2020 Annual Sales Market Share (%)	2020 Annual Sales Total Sales (GJ)	2020 Annual Useful Heat Overall Efficiency (%)	2020 Annual Useful Heat Total Useful Heat (GJ)	2025 Annual Sales Market Share (%)	2025 Annual Sales Total Sales (GJ)	2025 Annual Useful Heat Overall Efficiency (%)	2025 Annual Useful Heat Total Useful Heat (GJ)	2030 Annual Sales Market Share (%)	2030 Annual Sales Total Sales (GJ)	2030 Annual Useful Heat Overall Efficiency (%)	2030 Annual Useful Heat Total Useful Heat (GJ)
COMFORT HEATING	Boilers	1	Standard Efficiency Boiler	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		2	Near Condensing Boilers	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		3	Condensing Boiler	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Air Heating	4	Standard Efficiency Air Handling Units and Unit Heaters	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		5	High-efficiency Air Handling Units and Unit heaters (Condensing)	10%	147,720	66%	97,149	10%	140,119	68%	95,356	10%	132,962	70%	93,528	10%	126,215	73%	91,669
		6	Radiant Tube Heating	11%	174,147	75%	129,895	11%	166,473	76%	127,168	11%	159,048	78%	124,359	11%	151,875	80%	121,485

	END USE		TECHNOLOGY	2015 Market Share (%)	2015 Total Sales (GJ)	2015 Overall Efficiency (%)	2015 Total Useful Heat (GJ)	2020 Market Share (%)	2020 Total Sales (GJ)	2020 Overall Efficiency (%)	2020 Total Useful Heat (GJ)	2025 Market Share (%)	2025 Total Sales (GJ)	2025 Overall Efficiency (%)	2025 Total Useful Heat (GJ)	2030 Market Share (%)	2030 Total Sales (GJ)	2030 Overall Efficiency (%)	2030 Total Useful Heat (GJ)
PROCESS HEATING	Boilers	1	Standard Efficiency Boiler	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		2	Near Condensing Boiler	2%	27,157	68%	18,529	2%	25,696	71%	18,194	2%	24,311	73%	17,847	2%	22,998	76%	17,490
		3	Condensing Boiler	0%	6,721	77%	5,146	0%	6,667	79%	5,259	0%	6,593	81%	5,354	0%	6,504	84%	5,432
	Water Heaters	4	Tank-type Water Heating	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		5	Instantaneous Water Heater	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		6	Direct-fired Water Heating	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Ovens	7	Standard Efficiency Oven	1%	22,171	74%	16,406	1%	15,631	75%	11,692	1%	9,690	76%	7,325	0%	4,303	76%	3,288
		8	Efficient Oven	4%	65,298	85%	55,242	5%	67,704	85%	57,616	5%	69,709	86%	59,671	5%	71,347	86%	61,430
	Heat Treating	9	Standard Efficiency Heat Treating Furnace	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		10	Heat Treating Furnace with Sequential Firing, High-velocity Burners	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Lumber Kiln	11	Standard Efficiency Kiln	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		12	High-efficiency Kiln	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Veneer Dryers	13	Standard Efficiency Veneer Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		14	Advanced Veneer Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Paper	15	Direct-fired Paper Drying	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Pulp Lime Kilns	16	Standard Efficiency Pulp Lime Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		17	High-efficiency Pulp Lime Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Cement Kilns	18	Standard Efficiency Cement Kilns	31%	465,850	73%	339,604	29%	424,559	73%	309,504	28%	386,197	73%	281,538	26%	350,576	73%	255,570
		19	High-efficiency Cement Kilns	5%	80,715	82%	65,783	7%	97,752	82%	79,668	8%	112,926	82%	92,035	10%	126,377	82%	102,998
	Ore Drying	20	Standard Efficiency Ore Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		21	High-efficiency Ore Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Coal Drying	22	Standard Efficiency Coal Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		23	High-efficiency Coal Dryer (with centrifuge)	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Miscellaneous	24	Miscellaneous Standard Equipment	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		25	Miscellaneous Efficient Equipment	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Laundry	26	Direct-fired Gas Laundry Dryers	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Direct-fired	27	Direct-fired Heating	35%	536,399	66%	353,487	35%	512,767	68%	348,169	35%	490,018	70%	342,522	35%	468,141	72%	336,593
	Direct Consumption	28	Gas Consumed in Process	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Total			**100%**	**1,526,177**		**1,081,241**	**100%**	**1,457,367**		**1,052,624**	**100%**	**1,391,454**		**1,024,178**	**100%**	**1,328,337**		**995,954**

Economic Case Sub Sector Forecast Consumption and Market Share by Technology

ALL SERVICE AREAS

OTHER

	END USE		TECHNOLOGY	2015 Annual Sales Market Share (%)	2015 Annual Sales Total Sales (GJ)	2015 Annual Useful Heat Overall Efficiency (%)	2015 Annual Useful Heat Total Useful Heat (GJ)	2020 Annual Sales Market Share (%)	2020 Annual Sales Total Sales (GJ)	2020 Annual Useful Heat Overall Efficiency (%)	2020 Annual Useful Heat Total Useful Heat (GJ)	2025 Annual Sales Market Share (%)	2025 Annual Sales Total Sales (GJ)	2025 Annual Useful Heat Overall Efficiency (%)	2025 Annual Useful Heat Total Useful Heat (GJ)	2030 Annual Sales Market Share (%)	2030 Annual Sales Total Sales (GJ)	2030 Annual Useful Heat Overall Efficiency (%)	2030 Annual Useful Heat Total Useful Heat (GJ)
COMFORT HEATING	Boilers	1	Standard Efficiency Boiler	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		2	Near Condensing Boilers	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		3	Condensing Boiler	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Air Heating	4	Standard Efficiency Air Handling Units and Unit Heaters	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		5	High-efficiency Air Handling Units and Unit heaters (Condensing)	20%	123,709	67%	82,470	20%	117,362	69%	80,925	20%	111,383	71%	79,352	20%	105,743	74%	77,755
		6	Radiant Tube Heating	24%	145,960	75%	110,171	24%	139,530	77%	107,829	24%	133,309	79%	105,421	24%	127,299	81%	102,960

	END USE		TECHNOLOGY	2015 Market Share (%)	2015 Total Sales (GJ)	2015 Overall Efficiency (%)	2015 Total Useful Heat (GJ)	2020 Market Share (%)	2020 Total Sales (GJ)	2020 Overall Efficiency (%)	2020 Total Useful Heat (GJ)	2025 Market Share (%)	2025 Total Sales (GJ)	2025 Overall Efficiency (%)	2025 Total Useful Heat (GJ)	2030 Market Share (%)	2030 Total Sales (GJ)	2030 Overall Efficiency (%)	2030 Total Useful Heat (GJ)
PROCESS HEATING	Boilers	1	Standard Efficiency Boiler	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		2	Near Condensing Boiler	16%	100,773	68%	68,755	16%	95,283	71%	67,465	16%	90,086	73%	66,135	16%	85,166	76%	64,768
		3	Condensing Boiler	9%	55,493	77%	42,485	9%	53,668	79%	42,333	9%	51,866	81%	42,115	9%	50,091	84%	41,836
	Water Heaters	4	Tank-type Water Heating	4%	25,983	53%	13,844	4%	23,136	53%	12,372	4%	20,481	54%	10,992	3%	18,007	54%	9,699
		5	Instantaneous Water Heater	2%	15,410	71%	10,987	3%	16,524	71%	11,782	3%	17,517	71%	12,490	3%	18,397	71%	13,117
		6	Direct-fired Water Heating	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Ovens	7	Standard Efficiency Oven	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		8	Efficient Oven	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Heat Treating	9	Standard Efficiency Heat Treating Furnace	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		10	Heat Treating Furnace with Sequential Firing, High-velocity Burners	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Lumber Kiln	11	Standard Efficiency Kiln	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		12	High-efficiency Kiln	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Veneer Dryers	13	Standard Efficiency Veneer Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		14	Advanced Veneer Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Paper	15	Direct-fired Paper Drying	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Pulp Lime Kilns	16	Standard Efficiency Pulp Lime Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		17	High-efficiency Pulp Lime Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Cement Kilns	18	Standard Efficiency Cement Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		19	High-efficiency Cement Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Ore Drying	20	Standard Efficiency Ore Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		21	High-efficiency Ore Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Coal Drying	22	Standard Efficiency Coal Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		23	High-efficiency Coal Dryer (with centrifuge)	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Miscellaneous	24	Miscellaneous Standard Equipment	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		25	Miscellaneous Efficient Equipment	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Laundry	26	Direct-fired Gas Laundry Dryers	9%	55,835	52%	28,922	9%	53,098	54%	28,461	9%	50,496	55%	27,975	9%	48,021	57%	27,468
	Direct-fired	27	Direct-fired Heating	5%	33,071	56%	18,520	5%	31,450	58%	18,241	5%	29,908	60%	17,945	5%	28,443	62%	17,634
	Direct Consumption	28	Gas Consumed in Process	10%	63,278	100%	63,278	10%	60,177	100%	60,177	10%	57,227	100%	57,227	10%	54,423	100%	54,423
	Total			**100%**	**619,511**		**439,432**	**100%**	**590,227**		**429,585**	**100%**	**562,273**		**419,652**	**100%**	**535,588**		**409,660**

Economic Case Sub Sector Forecast Consumption and Market Share by Technology

ALL SERVICE AREAS

PULP AND PAPER

	END USE		TECHNOLOGY	2015				2020				2025				2030				
				Annual Sales		Annual Useful Heat		Annual Sales		Annual Useful Heat		Annual Sales		Annual Useful Heat		Annual Sales		Annual Useful Heat		
				Market Share (%)	Total Sales (GJ)	Overall Efficiency (%)	Total Useful Heat (GJ)	Market Share (%)	Total Sales (GJ)	Overall Efficiency (%)	Total Useful Heat (GJ)	Market Share (%)	Total Sales (GJ)	Overall Efficiency (%)	Total Useful Heat (GJ)	Market Share (%)	Total Sales (GJ)	Overall Efficiency (%)	Total Useful Heat (GJ)	
COMFORT HEATING	Boilers	1	Standard Efficiency Boiler	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	COMFORT HEATING
		2	Near Condensing Boilers	0%	26,081	81%	21,179	0%	25,931	84%	21,661	0%	25,779	86%	22,139	0%	25,623	88%	22,613	
		3	Condensing Boiler	0%	7,604	86%	6,549	0%	7,876	88%	6,929	0%	8,138	90%	7,312	0%	8,392	92%	7,696	
	Air Heating	4	Standard Efficiency Air Handling Units and Unit Heaters	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	
		5	High-efficiency Air Handling Units and Unit heaters (Condensing)	3%	257,241	72%	184,192	3%	256,245	74%	189,343	3%	255,349	76%	194,524	3%	254,542	78%	199,734	
		6	Radiant Tube Heating	2%	161,296	80%	129,563	2%	163,387	82%	134,185	2%	165,320	84%	138,749	2%	167,102	86%	143,253	

	END USE		TECHNOLOGY	2015 Market Share (%)	2015 Total Sales (GJ)	2015 Overall Efficiency (%)	2015 Total Useful Heat (GJ)	2020 Market Share (%)	2020 Total Sales (GJ)	2020 Overall Efficiency (%)	2020 Total Useful Heat (GJ)	2025 Market Share (%)	2025 Total Sales (GJ)	2025 Overall Efficiency (%)	2025 Total Useful Heat (GJ)	2030 Market Share (%)	2030 Total Sales (GJ)	2030 Overall Efficiency (%)	2030 Total Useful Heat (GJ)	
PROCESS HEATING	Boilers	1	Standard Efficiency Boiler	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	PROCESS HEATING
		2	Near Condensing Boiler	30%	2,197,281	80%	1,765,220	30%	2,234,629	83%	1,854,522	30%	2,268,469	86%	1,945,695	31%	2,301,531	89%	2,038,734	
		3	Condensing Boiler	7%	487,039	85%	415,024	6%	463,746	88%	405,984	6%	440,140	90%	395,574	6%	416,205	92%	383,758	
	Water Heaters	4	Tank-type Water Heating	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	
		5	Instantaneous Water Heater	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	
		6	Direct-fired Water Heating	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	
	Ovens	7	Standard Efficiency Oven	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	
		8	Efficient Oven	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	
	Heat Treating	9	Standard Efficiency Heat Treating Furnace	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	
		10	Heat Treating Furnace with Sequential Firing, High-velocity Burners	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	
	Lumber Kiln	11	Standard Efficiency Kiln	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	
		12	High-efficiency Kiln	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	
	Veneer Dryers	13	Standard Efficiency Veneer Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	
		14	Advanced Veneer Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	
	Paper	15	Direct-fired Paper Drying	19%	1,392,827	88%	1,222,206	19%	1,404,269	88%	1,233,397	19%	1,415,001	88%	1,244,610	19%	1,425,722	88%	1,255,842	
	Pulp Lime Kilns	16	Standard Efficiency Pulp Lime Kilns	28%	2,042,449	79%	1,603,322	26%	1,965,405	78%	1,536,517	25%	1,880,132	78%	1,469,712	24%	1,794,837	78%	1,402,907	
		17	High-efficiency Pulp Lime Kilns	11%	816,870	92%	751,521	12%	904,392	92%	832,041	13%	991,914	92%	912,561	14%	1,079,436	92%	993,081	
	Cement Kilns	18	Standard Efficiency Cement Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	
		19	High-efficiency Cement Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	
	Ore Drying	20	Standard Efficiency Ore Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	
		21	High-efficiency Ore Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	
	Coal Drying	22	Standard Efficiency Coal Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	
		23	High-efficiency Coal Dryer (with centrifuge)	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	
	Miscellaneous	24	Miscellaneous Standard Equipment	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	
		25	Miscellaneous Efficient Equipment	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	
	Laundry	26	Direct-fired Gas Laundry Dryers	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	
	Direct-fired	27	Direct-fired Heating	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	
	Direct Consumption	28	Gas Consumed in Process	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	
	Total			**100%**	**7,388,687**		**6,098,776**	**100%**	**7,425,880**		**6,214,579**	**100%**	**7,450,241**		**6,330,875**	**100%**	**7,473,389**		**6,447,618**	

Economic Case Sub Sector Forecast Consumption and Market Share by Technology

ALL SERVICE AREAS

WOOD PRODUCTS

	End Use		Technology	2015 Annual Sales Market Share (%)	2015 Annual Sales Total Sales (GJ)	2015 Annual Useful Heat Overall Efficiency (%)	2015 Annual Useful Heat Total Useful Heat (GJ)	2020 Annual Sales Market Share (%)	2020 Annual Sales Total Sales (GJ)	2020 Annual Useful Heat Overall Efficiency (%)	2020 Annual Useful Heat Total Useful Heat (GJ)	2025 Annual Sales Market Share (%)	2025 Annual Sales Total Sales (GJ)	2025 Annual Useful Heat Overall Efficiency (%)	2025 Annual Useful Heat Total Useful Heat (GJ)	2030 Annual Sales Market Share (%)	2030 Annual Sales Total Sales (GJ)	2030 Annual Useful Heat Overall Efficiency (%)	2030 Annual Useful Heat Total Useful Heat (GJ)	
COMFORT HEATING	Boilers	1	Standard Efficiency Boiler	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	COMFORT HEATING
		2	Near Condensing Boilers	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	
		3	Condensing Boiler	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	
	Air Heating	4	Standard Efficiency Air Handling Units and Unit Heaters	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	
		5	High-efficiency Air Handling Units and Unit heaters (Condensing)	2%	49,735	68%	33,902	2%	49,630	70%	34,965	2%	49,542	73%	36,037	2%	49,469	75%	37,116	
		6	Radiant Tube Heating	2%	58,773	77%	45,225	2%	59,080	79%	46,525	2%	59,356	81%	47,811	2%	59,603	82%	49,082	

	End Use		Technology	2015 Market Share (%)	2015 Total Sales (GJ)	2015 Overall Efficiency (%)	2015 Total Useful Heat (GJ)	2020 Market Share (%)	2020 Total Sales (GJ)	2020 Overall Efficiency (%)	2020 Total Useful Heat (GJ)	2025 Market Share (%)	2025 Total Sales (GJ)	2025 Overall Efficiency (%)	2025 Total Useful Heat (GJ)	2030 Market Share (%)	2030 Total Sales (GJ)	2030 Overall Efficiency (%)	2030 Total Useful Heat (GJ)	
PROCESS HEATING	Boilers	1	Standard Efficiency Boiler	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	PROCESS HEATING
		2	Near Condensing Boiler	7%	191,802	68%	130,862	7%	190,700	71%	135,025	7%	189,590	73%	139,183	7%	188,470	76%	143,332	
		3	Condensing Boiler	3%	77,765	77%	59,537	3%	79,752	79%	62,908	3%	81,682	81%	66,326	3%	83,556	84%	69,786	
	Water Heaters	4	Tank-type Water Heating	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	
		5	Instantaneous Water Heater	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	
		6	Direct-fired Water Heating	5%	130,174	76%	98,932	5%	129,490	78%	101,488	5%	128,846	81%	104,043	5%	128,239	83%	106,599	
	Ovens	7	Standard Efficiency Oven	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	
		8	Efficient Oven	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	
	Heat Treating	9	Standard Efficiency Heat Treating Furnace	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	
		10	Heat Treating Furnace with Sequential Firing, High-velocity Burners	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	
	Lumber Kiln	11	Standard Efficiency Kiln	18%	484,442	63%	306,409	13%	336,504	64%	216,709	7%	191,298	66%	125,396	2%	48,686	67%	32,474	
		12	High-efficiency Kiln	50%	1,320,366	89%	1,168,524	55%	1,480,038	89%	1,309,834	61%	1,638,210	89%	1,449,816	66%	1,794,877	89%	1,588,466	
	Veneer Dryers	13	Standard Efficiency Veneer Dryer	3%	75,641	53%	39,901	2%	50,897	53%	27,179	1%	26,587	54%	14,370	0%	2,697	55%	1,475	
		14	Advanced Veneer Dryer	10%	269,646	71%	191,449	11%	295,222	71%	209,608	12%	320,549	71%	227,590	13%	345,627	71%	245,395	
	Paper	15	Direct-fired Paper Drying	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	
	Pulp Lime Kilns	16	Standard Efficiency Pulp Lime Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	
		17	High-efficiency Pulp Lime Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	
	Cement Kilns	18	Standard Efficiency Cement Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	
		19	High-efficiency Cement Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	
	Ore Drying	20	Standard Efficiency Ore Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	
		21	High-efficiency Ore Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	
	Coal Drying	22	Standard Efficiency Coal Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	
		23	High-efficiency Coal Dryer (with centrifuge)	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	
	Miscellaneous	24	Miscellaneous Standard Equipment	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	
		25	Miscellaneous Efficient Equipment	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	
	Laundry	26	Direct-fired Gas Laundry Dryers	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	
	Direct-fired	27	Direct-fired Heating	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	
	Direct Consumption	28	Gas Consumed in Process	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	
	Total			**100%**	**2,658,344**		**2,074,741**	**100%**	**2,671,313**		**2,144,241**	**100%**	**2,685,660**		**2,210,571**	**100%**	**2,701,225**		**2,273,725**	

Economic Case 2015 Forecast Sales by Service Area and Sub Sector

LOWER MAINLAND

	END USE	TECHNOLOGY	Agriculture		Chemical		Fabricated Metal		Food & Beverage		Mining		Miscellaneous Manufacturing		Non-Metal Manufacturing		Pulp and Paper		Wood Products		Other	
			Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)
COMFORT HEATING	Boilers	1 Standard Efficiency Boiler	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		2 Near Condensing Boilers	0%	0	0%	0	0%	0	2%	47,986	9%	2,007	1%	3,317	0%	0	0%	2,353	0%	0	0%	0
		3 Condensing Boiler	0%	0	0%	0	0%	0	1%	24,858	3%	645	1%	1,431	0%	0	0%	687	0%	0	0%	0
	Air Heating	4 Standard Efficiency Air Handling Units and Unit Heaters	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		5 High-efficiency Air Handling Units and Unit heaters (Condensing)	11%	291,059	1%	28,224	10%	92,474	3%	70,442	16%	3,589	4%	11,196	6%	75,972	2%	23,565	1%	6,255	24%	92,730
		6 Radiant Tube Heating	9%	222,597	1%	32,785	20%	181,002	3%	74,295	24%	5,395	86%	242,178	7%	89,492	2%	14,616	1%	7,369	28%	109,232

	END USE	TECHNOLOGY	Agriculture Market Share	Agriculture Total Sales (GJ)	Chemical Market Share	Chemical Total Sales (GJ)	Fabricated Metal Market Share	Fabricated Metal Total Sales (GJ)	Food & Beverage Market Share	Food & Beverage Total Sales (GJ)	Mining Market Share	Mining Total Sales (GJ)	Miscellaneous Manufacturing Market Share	Miscellaneous Manufacturing Total Sales (GJ)	Non-Metal Manufacturing Market Share	Non-Metal Manufacturing Total Sales (GJ)	Pulp and Paper Market Share	Pulp and Paper Total Sales (GJ)	Wood Products Market Share	Wood Products Total Sales (GJ)	Other Market Share	Other Total Sales (GJ)
PROCESS HEATING	Boilers	1 Standard Efficiency Boiler	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		2 Near Condensing Boiler	0%	0	27%	583,014	6%	57,768	30%	762,000	0%	0	1%	3,036	2%	20,059	34%	329,792	7%	47,877	17%	65,356
		3 Condensing Boiler	78%	2,012,760	9%	186,626	1%	13,274	25%	646,263	0%	0	0%	887	0%	4,964	8%	78,052	3%	19,411	9%	32,921
	Water Heaters	4 Tank-type Water Heating	1%	36,903	0%	0	0%	0	3%	68,792	0%	0	1%	2,008	0%	0	0%	0	0%	0	4%	14,237
		5 Instantaneous Water Heater	0%	2,608	0%	0	0%	0	1%	34,322	0%	0	1%	2,292	0%	0	0%	0	0%	0	2%	7,117
		6 Direct-fired Water Heating	0%	0	0%	0	0%	0	19%	481,835	0%	0	0%	0	0%	0	0%	0	5%	32,494	0%	0
	Ovens	7 Standard Efficiency Oven	0%	0	0%	0	0%	0	2%	54,330	0%	0	0%	693	2%	19,998	0%	0	0%	0	0%	0
		8 Efficient Oven	0%	0	0%	0	0%	0	12%	310,104	0%	0	1%	4,079	5%	56,600	0%	0	0%	0	0%	0
	Heat Treating	9 Standard Efficiency Heat Treating Furnace	0%	0	0%	0	7%	62,892	0%	0	0%	0	0%	592	0%	0	0%	0	0%	0	0%	0
		10 Heat Treating Furnace with Sequential Firing, High-velocity Burners	0%	0	0%	0	42%	375,301	0%	0	0%	0	1%	3,825	0%	0	0%	0	0%	0	0%	0
	Lumber Kiln	11 Standard Efficiency Kiln	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	19%	120,925	0%	0
		12 High-efficiency Kiln	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	51%	329,585	0%	0
	Veneer Dryers	13 Standard Efficiency Veneer Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	3%	18,881	0%	0
		14 Advanced Veneer Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	10%	67,308	0%	0
	Paper	15 Direct-fired Paper Drying	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	22%	207,843	0%	0	0%	0
	Pulp Lime Kilns	16 Standard Efficiency Pulp Lime Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	23%	217,693	0%	0	0%	0
		17 High-efficiency Pulp Lime Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	9%	87,066	0%	0	0%	0
	Cement Kilns	18 Standard Efficiency Cement Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	33%	410,717	0%	0	0%	0	0%	0
		19 High-efficiency Cement Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	5%	62,776	0%	0	0%	0	0%	0
	Ore Drying	20 Standard Efficiency Ore Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		21 High-efficiency Ore Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Coal Drying	22 Standard Efficiency Coal Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		23 High-efficiency Coal Dryer (with centrifuge)	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Miscellaneous	24 Miscellaneous Standard Equipment	0%	0	0%	0	0%	0	0%	0	0%	0	1%	2,340	0%	0	0%	0	0%	0	0%	0
		25 Miscellaneous Efficient Equipment	0%	0	0%	0	0%	0	0%	0	0%	0	1%	2,671	0%	0	0%	0	0%	0	0%	0
	Laundry	26 Direct-fired Gas Laundry Dryers	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	7%	25,480
	Direct-fired	27 Direct-fired Heating	0%	0	29%	627,379	12%	109,788	0%	0	49%	11,228	0%	0	40%	485,706	0%	0	0%	0	3%	11,395
	Direct Consumption	28 Gas Consumed in Process	0%	0	33%	731,727	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	7%	28,487
	Total		**100%**	**2,565,927**	**100%**	**2,189,756**	**100%**	**892,498**	**100%**	**2,575,227**	**100%**	**22,863**	**100%**	**280,546**	**100%**	**1,226,285**	**100%**	**961,667**	**100%**	**650,105**	**100%**	**386,955**

Economic Case 2015 Forecast Sales by Service Area and Sub Sector

	NORTHERN INTERIOR		Agriculture		Chemical		Fabricated Metal		Food & Beverage		Mining		Miscellaneous Manufacturing		Non-Metal Manufacturing		Pulp and Paper		Wood Products		Other	
	END USE	TECHNOLOGY	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)
COMFORT HEATING	Boilers	1 Standard Efficiency Boiler	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		2 Near Condensing Boilers	0%	0	0%	0	0%	0	4%	2,235	4%	9,002	2%	424	0%	0	0%	19,337	0%	0	0%	0
		3 Condensing Boiler	0%	0	0%	0	0%	0	2%	1,270	2%	4,961	1%	183	0%	0	0%	5,639	0%	0	0%	0
	Air Heating	4 Standard Efficiency Air Handling Units and Unit Heaters	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		5 High-efficiency Air Handling Units and Unit heaters (Condensing)	20%	14,174	2%	12,120	7%	12,214	8%	4,818	4%	8,486	7%	1,419	9%	9,420	4%	191,016	2%	30,164	26%	18,875
		6 Radiant Tube Heating	15%	10,897	11%	70,312	13%	23,611	9%	5,249	6%	13,171	85%	17,607	11%	11,137	2%	119,873	3%	35,662	31%	22,389
PROCESS HEATING	Boilers	1 Standard Efficiency Boiler	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		2 Near Condensing Boiler	0%	0	26%	168,747	0%	0	24%	14,198	17%	35,497	1%	131	1%	697	29%	1,524,303	7%	94,230	10%	7,068
		3 Condensing Boiler	63%	45,322	2%	14,041	0%	0	22%	12,915	11%	23,099	0%	38	0%	172	6%	333,607	3%	38,205	4%	3,123
	Water Heaters	4 Tank-type Water Heating	1%	989	0%	0	0%	0	4%	2,277	0%	0	0%	86	0%	0	0%	0	0%	0	3%	2,096
		5 Instantaneous Water Heater	0%	70	0%	0	0%	0	2%	1,136	0%	0	0%	99	0%	0	0%	0	0%	0	2%	1,270
		6 Direct-fired Water Heating	0%	0	0%	0	0%	0	12%	7,351	0%	0	0%	0	0%	0	0%	0	5%	63,953	0%	0
	Ovens	7 Standard Efficiency Oven	0%	0	0%	0	0%	0	2%	1,234	0%	0	0%	30	0%	213	0%	0	0%	0	0%	0
		8 Efficient Oven	0%	0	0%	0	0%	0	11%	6,837	0%	0	1%	175	1%	853	0%	0	0%	0	0%	0
	Heat Treating	9 Standard Efficiency Heat Treating Furnace	0%	0	0%	0	10%	17,816	0%	0	0%	0	0%	25	0%	0	0%	0	0%	0	0%	0
		10 Heat Treating Furnace with Sequential Firing, High-velocity Burners	0%	0	0%	0	52%	92,909	0%	0	0%	0	1%	165	0%	0	0%	0	0%	0	0%	0
	Lumber Kiln	11 Standard Efficiency Kiln	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	18%	238,000	0%	0
		12 High-efficiency Kiln	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	49%	648,680	0%	0
	Veneer Dryers	13 Standard Efficiency Veneer Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	3%	37,161	0%	0
		14 Advanced Veneer Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	10%	132,474	0%	0
	Paper	15 Direct-fired Paper Drying	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	18%	966,742	0%	0	0%	0
	Pulp Lime Kilns	16 Standard Efficiency Pulp Lime Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	28%	1,492,071	0%	0	0%	0
		17 High-efficiency Pulp Lime Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	11%	596,749	0%	0	0%	0
	Cement Kilns	18 Standard Efficiency Cement Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	31%	31,797	0%	0	0%	0	0%	0
		19 High-efficiency Cement Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	3%	3,011	0%	0	0%	0	0%	0
	Ore Drying	20 Standard Efficiency Ore Dryer	0%	0	0%	0	0%	0	0%	0	52%	106,927	0%	0	0%	0	0%	0	0%	0	0%	0
		21 High-efficiency Ore Dryer	0%	0	0%	0	0%	0	0%	0	2%	4,808	0%	0	0%	0	0%	0	0%	0	0%	0
	Coal Drying	22 Standard Efficiency Coal Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		23 High-efficiency Coal Dryer (with centrifuge)	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Miscellaneous	24 Miscellaneous Standard Equipment	0%	0	0%	0	0%	0	0%	0	0%	0	0%	101	0%	0	0%	0	0%	0	0%	0
		25 Miscellaneous Efficient Equipment	0%	0	0%	0	0%	0	0%	0	0%	0	1%	115	0%	0	0%	0	0%	0	0%	0
	Laundry	26 Direct-fired Gas Laundry Dryers	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	3%	2,093
	Direct-fired	27 Direct-fired Heating	0%	0	25%	162,901	18%	32,881	0%	0	0%	0	0%	0	44%	44,820	0%	0	0%	0	14%	9,852
	Direct Consumption	28 Gas Consumed in Process	0%	0	33%	214,596	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	7%	5,232
	Total		**100%**	**71,452**	**100%**	**642,717**	**100%**	**179,431**	**100%**	**59,521**	**100%**	**205,949**	**100%**	**20,598**	**100%**	**102,121**	**100%**	**5,249,337**	**100%**	**1,318,529**	**100%**	**71,999**

Economic Case 2015 Forecast Sales by Service Area and Sub Sector

SOUTHERN INTERIOR

	END USE		TECHNOLOGY	Agriculture		Chemical		Fabricated Metal		Food & Beverage		Mining		Miscellaneous Manufacturing		Non-Metal Manufacturing		Pulp and Paper		Wood Products		Other	
				Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)
COMFORT HEATING	Boilers	1	Standard Efficiency Boiler	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		2	Near Condensing Boilers	0%	0	0%	0	0%	0	3%	9,667	3%	50,865	8%	1,654	0%	0	0%	4,240	0%	0	0%	0
		3	Condensing Boiler	0%	0	0%	0	0%	0	2%	5,493	2%	39,656	4%	713	0%	0	0%	1,239	0%	0	0%	0
	Air Heating	4	Standard Efficiency Air Handling Units and Unit Heaters	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		5	High-efficiency Air Handling Units and Unit heaters (Condensing)	11%	10,164	15%	5,992	21%	13,713	8%	28,060	0%	5,992	27%	5,532	20%	22,888	4%	42,528	2%	13,316	32%	9,845
		6	Radiant Tube Heating	8%	7,814	17%	7,027	40%	26,332	9%	31,224	1%	13,249	31%	6,358	24%	27,060	2%	26,657	3%	15,743	38%	11,678

	END USE		TECHNOLOGY	Agriculture Market Share	Agriculture Total Sales (GJ)	Chemical Market Share	Chemical Total Sales (GJ)	Fabricated Metal Market Share	Fabricated Metal Total Sales (GJ)	Food & Beverage Market Share	Food & Beverage Total Sales (GJ)	Mining Market Share	Mining Total Sales (GJ)	Miscellaneous Manufacturing Market Share	Miscellaneous Manufacturing Total Sales (GJ)	Non-Metal Manufacturing Market Share	Non-Metal Manufacturing Total Sales (GJ)	Pulp and Paper Market Share	Pulp and Paper Total Sales (GJ)	Wood Products Market Share	Wood Products Total Sales (GJ)	Other Market Share	Other Total Sales (GJ)
PROCESS HEATING	Boilers	1	Standard Efficiency Boiler	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		2	Near Condensing Boiler	0%	0	28%	11,462	0%	0	28%	96,026	21%	400,098	4%	805	6%	6,402	29%	340,339	7%	41,599	9%	2,921
		3	Condensing Boiler	80%	77,165	11%	4,547	0%	0	19%	63,904	13%	260,355	1%	235	1%	1,584	6%	74,524	3%	16,866	4%	1,291
	Water Heaters	4	Tank-type Water Heating	2%	1,521	0%	0	0%	0	3%	10,031	0%	0	3%	532	0%	0	0%	0	0%	0	3%	866
		5	Instantaneous Water Heater	0%	107	0%	0	0%	0	1%	5,005	0%	0	3%	608	0%	0	0%	0	0%	0	2%	525
		6	Direct-fired Water Heating	0%	0	0%	0	0%	0	12%	42,000	0%	0	0%	0	0%	0	0%	0	5%	28,233	0%	0
	Ovens	7	Standard Efficiency Oven	0%	0	0%	0	0%	0	2%	7,027	0%	0	1%	184	2%	1,959	0%	0	0%	0	0%	0
		8	Efficient Oven	0%	0	0%	0	0%	0	12%	38,957	0%	0	5%	1,082	7%	7,844	0%	0	0%	0	0%	0
	Heat Treating	9	Standard Efficiency Heat Treating Furnace	0%	0	0%	0	5%	3,217	0%	0	0%	0	1%	157	0%	0	0%	0	0%	0	0%	0
		10	Heat Treating Furnace with Sequential Firing, High-velocity Burners	0%	0	0%	0	27%	17,978	0%	0	0%	0	5%	1,014	0%	0	0%	0	0%	0	0%	0
	Lumber Kiln	11	Standard Efficiency Kiln	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	18%	105,068	0%	0
		12	High-efficiency Kiln	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	49%	286,368	0%	0
	Veneer Dryers	13	Standard Efficiency Veneer Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	3%	16,405	0%	0
		14	Advanced Veneer Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	10%	58,482	0%	0
	Paper	15	Direct-fired Paper Drying	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	18%	215,932	0%	0	0%	0
	Pulp Lime Kilns	16	Standard Efficiency Pulp Lime Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	28%	332,684	0%	0	0%	0
		17	High-efficiency Pulp Lime Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	11%	133,056	0%	0	0%	0
	Cement Kilns	18	Standard Efficiency Cement Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	21%	23,336	0%	0	0%	0	0%	0
		19	High-efficiency Cement Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	13%	14,928	0%	0	0%	0	0%	0
	Ore Drying	20	Standard Efficiency Ore Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		21	High-efficiency Ore Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Coal Drying	22	Standard Efficiency Coal Dryer	0%	0	0%	0	0%	0	0%	0	58%	1,122,808	0%	0	0%	0	0%	0	0%	0	0%	0
		23	High-efficiency Coal Dryer (with centrifuge)	0%	0	0%	0	0%	0	0%	0	3%	54,194	0%	0	0%	0	0%	0	0%	0	0%	0
	Miscellaneous	24	Miscellaneous Standard Equipment	0%	0	0%	0	0%	0	0%	0	0%	0	3%	620	0%	0	0%	0	0%	0	0%	0
		25	Miscellaneous Efficient Equipment	0%	0	0%	0	0%	0	0%	0	0%	0	4%	708	0%	0	0%	0	0%	0	0%	0
	Laundry	26	Direct-fired Gas Laundry Dryers	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	3%	865
	Direct-fired	27	Direct-fired Heating	0%	0	29%	11,979	7%	4,589	0%	0	0%	0	0%	0	5%	5,873	0%	0	0%	0	3%	865
	Direct Consumption	28	Gas Consumed in Process	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	7%	2,162
	Total			**100%**	**96,772**	**100%**	**41,007**	**100%**	**65,830**	**100%**	**337,394**	**100%**	**1,947,218**	**100%**	**20,203**	**100%**	**111,875**	**100%**	**1,171,199**	**100%**	**582,081**	**100%**	**31,017**

Economic Case 2015 Forecast Sales by Service Area and Sub Sector

	VANCOUVER ISLAND		Agriculture		Chemical		Fabricated Metal		Food & Beverage		Mining		Miscellaneous Manufacturing		Non-Metal Manufacturing		Pulp and Paper		Wood Products		Other	
	END USE	TECHNOLOGY	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)
COMFORT HEATING	Boilers	1 Standard Efficiency Boiler	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		2 Near Condensing Boilers	0%	0	0%	0	0%	0	1%	980	0%	0	1%	112	0%	0	2%	151	0%	0	0%	0
		3 Condensing Boiler	0%	0	0%	0	0%	0	0%	557	0%	0	0%	48	0%	0	1%	39	0%	0	0%	0
	Air Heating	4 Standard Efficiency Air Handling Units and Unit Heaters	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		5 High-efficiency Air Handling Units and Unit heaters (Condensing)	2%	547	9%	12,478	16%	1,190	2%	2,132	0%	0	2%	376	46%	39,439	2%	133	0%	0	2%	2,260
		6 Radiant Tube Heating	2%	418	10%	14,494	31%	2,280	2%	2,303	0%	0	3%	430	54%	46,458	2%	150	0%	0	2%	2,662
PROCESS HEATING	Boilers	1 Standard Efficiency Boiler	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		2 Near Condensing Boiler	0%	0	10%	13,778	0%	0	39%	45,377	0%	0	13%	2,145	0%	0	44%	2,847	8%	8,096	20%	25,429
		3 Condensing Boiler	94%	21,355	3%	4,705	0%	0	30%	35,581	0%	0	4%	627	0%	0	13%	854	3%	3,282	14%	18,158
	Water Heaters	4 Tank-type Water Heating	2%	431	0%	0	0%	0	5%	5,679	0%	0	8%	1,419	0%	0	0%	0	0%	0	7%	8,783
		5 Instantaneous Water Heater	0%	30	0%	0	0%	0	2%	2,834	0%	0	10%	1,619	0%	0	0%	0	0%	0	5%	6,498
		6 Direct-fired Water Heating	0%	0	0%	0	0%	0	18%	21,420	0%	0	0%	0	0%	0	0%	0	5%	5,495	0%	0
	Ovens	7 Standard Efficiency Oven	0%	0	0%	0	0%	0	0%	0	0%	0	3%	490	0%	0	0%	0	0%	0	0%	0
		8 Efficient Oven	0%	0	0%	0	0%	0	0%	0	0%	0	17%	2,882	0%	0	0%	0	0%	0	0%	0
	Heat Treating	9 Standard Efficiency Heat Treating Furnace	0%	0	0%	0	7%	473	0%	0	0%	0	2%	419	0%	0	0%	0	0%	0	0%	0
		10 Heat Treating Furnace with Sequential Firing, High-velocity Burners	0%	0	0%	0	36%	2,645	0%	0	0%	0	16%	2,703	0%	0	0%	0	0%	0	0%	0
	Lumber Kiln	11 Standard Efficiency Kiln	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	19%	20,449	0%	0
		12 High-efficiency Kiln	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	52%	55,733	0%	0
	Veneer Dryers	13 Standard Efficiency Veneer Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	3%	3,193	0%	0
		14 Advanced Veneer Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	11%	11,382	0%	0
	Paper	15 Direct-fired Paper Drying	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	36%	2,310	0%	0	0%	0
	Pulp Lime Kilns	16 Standard Efficiency Pulp Lime Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		17 High-efficiency Pulp Lime Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Cement Kilns	18 Standard Efficiency Cement Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		19 High-efficiency Cement Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Ore Drying	20 Standard Efficiency Ore Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		21 High-efficiency Ore Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Coal Drying	22 Standard Efficiency Coal Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		23 High-efficiency Coal Dryer (with centrifuge)	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Miscellaneous	24 Miscellaneous Standard Equipment	0%	0	0%	0	0%	0	0%	0	0%	0	10%	1,653	0%	0	0%	0	0%	0	0%	0
		25 Miscellaneous Efficient Equipment	0%	0	0%	0	0%	0	0%	0	0%	0	11%	1,887	0%	0	0%	0	0%	0	0%	0
	Laundry	26 Direct-fired Gas Laundry Dryers	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	21%	27,397
	Direct-fired	27 Direct-fired Heating	0%	0	67%	93,166	9%	675	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	8%	10,959
	Direct Consumption	28 Gas Consumed in Process	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	21%	27,397
	Total		**100%**	**22,781**	**100%**	**138,621**	**100%**	**7,263**	**100%**	**116,863**	**0%**	**0**	**100%**	**16,810**	**100%**	**85,897**	**100%**	**6,484**	**100%**	**107,630**	**100%**	**129,541**

Economic Case 2015 Forecast Sales by Service Area and Sub Sector

	TOTAL SERVICE AREAS		Agriculture		Chemical		Fabricated Metal		Food & Beverage		Mining		Miscellaneous Manufacturing		Non-Metal Manufacturing		Pulp and Paper		Wood Products		Other	
	END USE	TECHNOLOGY	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)
COMFORT HEATING	Boilers	1 Standard Efficiency Boiler	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		2 Near Condensing Boilers	0%	0	0%	0	0%	0	2%	60,868	3%	61,874	2%	5,507	0%	0	0%	26,081	0%	0	0%	0
		3 Condensing Boiler	0%	0	0%	0	0%	0	1%	32,177	2%	45,262	1%	2,376	0%	0	0%	7,604	0%	0	0%	0
	Air Heating	4 Standard Efficiency Air Handling Units and Unit Heaters	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		5 High-efficiency Air Handling Units and Unit heaters (Condensing)	11%	315,944	2%	58,813	10%	119,590	3%	105,452	1%	18,066	5%	18,523	10%	147,720	3%	257,241	2%	49,735	20%	123,709
		6 Radiant Tube Heating	9%	241,725	4%	124,618	20%	233,224	4%	113,071	1%	31,815	79%	266,574	11%	174,147	2%	161,296	2%	58,773	24%	145,960

	END USE	TECHNOLOGY	Agriculture Market Share	Agriculture Total Sales (GJ)	Chemical Market Share	Chemical Total Sales (GJ)	Fabricated Metal Market Share	Fabricated Metal Total Sales (GJ)	Food & Beverage Market Share	Food & Beverage Total Sales (GJ)	Mining Market Share	Mining Total Sales (GJ)	Miscellaneous Manufacturing Market Share	Miscellaneous Manufacturing Total Sales (GJ)	Non-Metal Manufacturing Market Share	Non-Metal Manufacturing Total Sales (GJ)	Pulp and Paper Market Share	Pulp and Paper Total Sales (GJ)	Wood Products Market Share	Wood Products Total Sales (GJ)	Other Market Share	Other Total Sales (GJ)
PROCESS HEATING	Boilers	1 Standard Efficiency Boiler	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		2 Near Condensing Boiler	0%	0	26%	777,001	5%	57,768	30%	917,601	20%	435,595	2%	6,116	2%	27,157	30%	2,197,281	7%	191,802	16%	100,773
		3 Condensing Boiler	78%	2,156,602	7%	209,920	1%	13,274	25%	758,663	13%	283,453	1%	1,788	0%	6,721	7%	487,039	3%	77,765	9%	55,493
	Water Heaters	4 Tank-type Water Heating	1%	39,845	0%	0	0%	0	3%	86,780	0%	0	1%	4,045	0%	0	0%	0	0%	0	4%	25,983
		5 Instantaneous Water Heater	0%	2,816	0%	0	0%	0	1%	43,297	0%	0	1%	4,617	0%	0	0%	0	0%	0	2%	15,410
		6 Direct-fired Water Heating	0%	0	0%	0	0%	0	18%	552,607	0%	0	0%	0	0%	0	0%	0	5%	130,174	0%	0
	Ovens	7 Standard Efficiency Oven	0%	0	0%	0	0%	0	2%	62,590	0%	0	0%	1,397	1%	22,171	0%	0	0%	0	0%	0
		8 Efficient Oven	0%	0	0%	0	0%	0	12%	355,898	0%	0	2%	8,219	4%	65,298	0%	0	0%	0	0%	0
	Heat Treating	9 Standard Efficiency Heat Treating Furnace	0%	0	0%	0	7%	84,399	0%	0	0%	0	0%	1,193	0%	0	0%	0	0%	0	0%	0
		10 Heat Treating Furnace with Sequential Firing, High-velocity Burners	0%	0	0%	0	43%	488,833	0%	0	0%	0	2%	7,707	0%	0	0%	0	0%	0	0%	0
	Lumber Kiln	11 Standard Efficiency Kiln	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	18%	484,442	0%	0
		12 High-efficiency Kiln	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	50%	1,320,366	0%	0
	Veneer Dryers	13 Standard Efficiency Veneer Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	3%	75,641	0%	0
		14 Advanced Veneer Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	10%	269,646	0%	0
	Paper	15 Direct-fired Paper Drying	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	19%	1,392,827	0%	0	0%	0
	Pulp Lime Kilns	16 Standard Efficiency Pulp Lime Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	28%	2,042,449	0%	0	0%	0
		17 High-efficiency Pulp Lime Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	11%	816,870	0%	0	0%	0
	Cement Kilns	18 Standard Efficiency Cement Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	31%	465,850	0%	0	0%	0	0%	0
		19 High-efficiency Cement Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	5%	80,715	0%	0	0%	0	0%	0
	Ore Drying	20 Standard Efficiency Ore Dryer	0%	0	0%	0	0%	0	0%	0	5%	106,927	0%	0	0%	0	0%	0	0%	0	0%	0
		21 High-efficiency Ore Dryer	0%	0	0%	0	0%	0	0%	0	0%	4,808	0%	0	0%	0	0%	0	0%	0	0%	0
	Coal Drying	22 Standard Efficiency Coal Dryer	0%	0	0%	0	0%	0	0%	0	52%	1,122,808	0%	0	0%	0	0%	0	0%	0	0%	0
		23 High-efficiency Coal Dryer (with centrifuge)	0%	0	0%	0	0%	0	0%	0	2%	54,194	0%	0	0%	0	0%	0	0%	0	0%	0
	Miscellaneous	24 Miscellaneous Standard Equipment	0%	0	0%	0	0%	0	0%	0	0%	0	1%	4,714	0%	0	0%	0	0%	0	0%	0
		25 Miscellaneous Efficient Equipment	0%	0	0%	0	0%	0	0%	0	0%	0	2%	5,381	0%	0	0%	0	0%	0	0%	0
	Laundry	26 Direct-fired Gas Laundry Dryers	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	9%	55,835
	Direct-fired	27 Direct-fired Heating	0%	0	30%	895,425	13%	147,933	0%	0	1%	11,228	0%	0	35%	536,399	0%	0	0%	0	5%	33,071
	Direct Consumption	28 Gas Consumed in Process	0%	0	31%	946,323	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	10%	63,278
	Total		**100%**	**2,756,931**	**100%**	**3,012,100**	**100%**	**1,145,023**	**100%**	**3,089,004**	**100%**	**2,176,030**	**100%**	**338,156**	**100%**	**1,526,177**	**100%**	**7,388,687**	**100%**	**2,658,344**	**100%**	**619,511**

Economic Case 2020 Forecast Sales by Service Area and Sub Sector

	LOWER MAINLAND		Agriculture		Chemical		Fabricated Metal		Food & Beverage		Mining		Miscellaneous Manufacturing		Non-Metal Manufacturing		Pulp and Paper		Wood Products		Other	
	END USE	TECHNOLOGY	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)
COMFORT HEATING	Boilers	1 Standard Efficiency Boiler	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		2 Near Condensing Boilers	0%	0	0%	0	0%	0	2%	47,838	9%	2,000	1%	3,143	0%	0	0%	2,340	0%	0	0%	0
		3 Condensing Boiler	0%	0	0%	0	0%	0	1%	25,626	3%	674	1%	1,393	0%	0	0%	712	0%	0	0%	0
	Air Heating	4 Standard Efficiency Air Handling Units and Unit Heaters	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		5 High-efficiency Air Handling Units and Unit heaters (Condensing)	12%	298,121	1%	28,253	10%	87,610	3%	70,320	16%	3,564	4%	10,599	6%	72,052	2%	23,447	1%	6,238	24%	87,945
		6 Radiant Tube Heating	9%	230,344	2%	33,161	20%	171,688	3%	74,958	24%	5,375	86%	227,776	7%	85,548	2%	14,813	1%	7,407	28%	104,417
PROCESS HEATING	Boilers	1 Standard Efficiency Boiler	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		2 Near Condensing Boiler	0%	0	26%	579,366	6%	54,805	30%	764,828	0%	0	1%	2,870	2%	18,980	35%	337,121	7%	47,602	17%	61,796
		3 Condensing Boiler	78%	2,020,434	9%	189,472	2%	12,884	25%	654,722	0%	0	0%	879	0%	4,924	8%	73,946	3%	19,907	9%	31,920
	Water Heaters	4 Tank-type Water Heating	1%	34,084	0%	0	0%	0	2%	64,412	0%	0	1%	1,788	0%	0	0%	0	0%	0	3%	12,677
		5 Instantaneous Water Heater	0%	5,183	0%	0	0%	0	2%	39,478	0%	0	1%	2,332	0%	0	0%	0	0%	0	2%	7,783
		6 Direct-fired Water Heating	0%	0	0%	0	0%	0	19%	482,348	0%	0	0%	0	0%	0	0%	0	5%	32,323	0%	0
	Ovens	7 Standard Efficiency Oven	0%	0	0%	0	0%	0	1%	38,060	0%	0	0%	481	1%	14,063	0%	0	0%	0	0%	0
		8 Efficient Oven	0%	0	0%	0	0%	0	13%	326,537	0%	0	2%	4,062	5%	58,915	0%	0	0%	0	0%	0
	Heat Treating	9 Standard Efficiency Heat Treating Furnace	0%	0	0%	0	5%	42,097	0%	0	0%	0	0%	454	0%	0	0%	0	0%	0	0%	0
		10 Heat Treating Furnace with Sequential Firing, High-velocity Burners	0%	0	0%	0	44%	379,305	0%	0	0%	0	1%	3,792	0%	0	0%	0	0%	0	0%	0
	Lumber Kiln	11 Standard Efficiency Kiln	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	13%	83,997	0%	0
		12 High-efficiency Kiln	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	57%	369,442	0%	0
	Veneer Dryers	13 Standard Efficiency Veneer Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	2%	12,705	0%	0
		14 Advanced Veneer Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	11%	73,692	0%	0
	Paper	15 Direct-fired Paper Drying	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	21%	209,583	0%	0	0%	0
	Pulp Lime Kilns	16 Standard Efficiency Pulp Lime Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	22%	216,680	0%	0	0%	0
		17 High-efficiency Pulp Lime Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	10%	96,394	0%	0	0%	0
	Cement Kilns	18 Standard Efficiency Cement Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	32%	374,313	0%	0	0%	0	0%	0
		19 High-efficiency Cement Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	7%	78,208	0%	0	0%	0	0%	0
	Ore Drying	20 Standard Efficiency Ore Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		21 High-efficiency Ore Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Coal Drying	22 Standard Efficiency Coal Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		23 High-efficiency Coal Dryer (with centrifuge)	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Miscellaneous	24 Miscellaneous Standard Equipment	0%	0	0%	0	0%	0	0%	0	0%	0	1%	2,068	0%	0	0%	0	0%	0	0%	0
		25 Miscellaneous Efficient Equipment	0%	0	0%	0	0%	0	0%	0	0%	0	1%	2,697	0%	0	0%	0	0%	0	0%	0
	Laundry	26 Direct-fired Gas Laundry Dryers	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	7%	24,231
	Direct-fired	27 Direct-fired Heating	0%	0	29%	630,646	12%	104,407	0%	0	49%	11,228	0%	0	40%	464,307	0%	0	0%	0	3%	10,836
	Direct Consumption	28 Gas Consumed in Process	0%	0	33%	731,727	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	7%	27,091
	Total		**100%**	**2,588,167**	**100%**	**2,192,624**	**100%**	**852,797**	**100%**	**2,589,126**	**100%**	**22,840**	**100%**	**264,335**	**100%**	**1,171,311**	**100%**	**975,037**	**100%**	**653,313**	**100%**	**368,697**

Economic Case 2020 Forecast Sales by Service Area and Sub Sector

NORTHERN INTERIOR

	END USE	TECHNOLOGY	Agriculture Market Share	Agriculture Total Sales (GJ)	Chemical Market Share	Chemical Total Sales (GJ)	Fabricated Metal Market Share	Fabricated Metal Total Sales (GJ)	Food & Beverage Market Share	Food & Beverage Total Sales (GJ)	Mining Market Share	Mining Total Sales (GJ)	Miscellaneous Manufacturing Market Share	Miscellaneous Manufacturing Total Sales (GJ)	Non-Metal Manufacturing Market Share	Non-Metal Manufacturing Total Sales (GJ)	Pulp and Paper Market Share	Pulp and Paper Total Sales (GJ)	Wood Products Market Share	Wood Products Total Sales (GJ)	Other Market Share	Other Total Sales (GJ)
COMFORT HEATING	Boilers	1 Standard Efficiency Boiler	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		2 Near Condensing Boilers	0%	0	0%	0	0%	0	4%	2,228	4%	8,970	2%	402	0%	0	0%	19,223	0%	0	0%	0
		3 Condensing Boiler	0%	0	0%	0	0%	0	2%	1,305	2%	5,050	1%	178	0%	0	0%	5,839	0%	0	0%	0
	Air Heating	4 Standard Efficiency Air Handling Units and Unit Heaters	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		5 High-efficiency Air Handling Units and Unit heaters (Condensing)	19%	14,055	2%	12,148	7%	11,580	8%	4,817	4%	8,440	7%	1,345	9%	8,940	4%	190,296	2%	30,102	26%	17,924
		6 Radiant Tube Heating	15%	10,905	11%	69,867	13%	22,406	9%	5,295	6%	13,130	85%	16,570	11%	10,647	2%	121,419	3%	35,848	31%	21,404
PROCESS HEATING	Boilers	1 Standard Efficiency Boiler	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		2 Near Condensing Boiler	0%	0	26%	167,778	0%	0	24%	14,240	17%	35,291	1%	123	1%	659	29%	1,549,070	7%	93,689	10%	6,683
		3 Condensing Boiler	65%	48,208	2%	14,643	0%	0	22%	13,050	11%	23,263	0%	38	0%	171	6%	317,967	3%	39,181	4%	3,043
	Water Heaters	4 Tank-type Water Heating	1%	922	0%	0	0%	0	4%	2,132	0%	0	0%	77	0%	0	0%	0	0%	0	3%	1,867
		5 Instantaneous Water Heater	0%	140	0%	0	0%	0	2%	1,307	0%	0	1%	100	0%	0	0%	0	0%	0	2%	1,359
		6 Direct-fired Water Heating	0%	0	0%	0	0%	0	12%	7,359	0%	0	0%	0	0%	0	0%	0	5%	63,617	0%	0
	Ovens	7 Standard Efficiency Oven	0%	0	0%	0	0%	0	1%	868	0%	0	0%	21	0%	154	0%	0	0%	0	0%	0
		8 Efficient Oven	0%	0	0%	0	0%	0	12%	7,206	0%	0	1%	175	1%	862	0%	0	0%	0	0%	0
	Heat Treating	9 Standard Efficiency Heat Treating Furnace	0%	0	0%	0	7%	11,782	0%	0	0%	0	0%	20	0%	0	0%	0	0%	0	0%	0
		10 Heat Treating Furnace with Sequential Firing, High-velocity Burners	0%	0	0%	0	55%	94,804	0%	0	0%	0	1%	163	0%	0	0%	0	0%	0	0%	0
	Lumber Kiln	11 Standard Efficiency Kiln	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	12%	165,320	0%	0
		12 High-efficiency Kiln	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	55%	727,125	0%	0
	Veneer Dryers	13 Standard Efficiency Veneer Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	2%	25,005	0%	0
		14 Advanced Veneer Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	11%	145,039	0%	0
	Paper	15 Direct-fired Paper Drying	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	18%	974,338	0%	0	0%	0
	Pulp Lime Kilns	16 Standard Efficiency Pulp Lime Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	27%	1,429,902	0%	0	0%	0
		17 High-efficiency Pulp Lime Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	13%	660,686	0%	0	0%	0
	Cement Kilns	18 Standard Efficiency Cement Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	30%	28,979	0%	0	0%	0	0%	0
		19 High-efficiency Cement Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	4%	4,296	0%	0	0%	0	0%	0
	Ore Drying	20 Standard Efficiency Ore Dryer	0%	0	0%	0	0%	0	0%	0	50%	102,471	0%	0	0%	0	0%	0	0%	0	0%	0
		21 High-efficiency Ore Dryer	0%	0	0%	0	0%	0	0%	0	5%	9,616	0%	0	0%	0	0%	0	0%	0	0%	0
	Coal Drying	22 Standard Efficiency Coal Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		23 High-efficiency Coal Dryer (with centrifuge)	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Miscellaneous	24 Miscellaneous Standard Equipment	0%	0	0%	0	0%	0	0%	0	0%	0	0%	89	0%	0	0%	0	0%	0	0%	0
		25 Miscellaneous Efficient Equipment	0%	0	0%	0	0%	0	0%	0	0%	0	1%	116	0%	0	0%	0	0%	0	0%	0
	Laundry	26 Direct-fired Gas Laundry Dryers	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	3%	1,990
	Direct-fired	27 Direct-fired Heating	0%	0	25%	163,749	18%	31,269	0%	0	0%	0	0%	0	44%	42,846	0%	0	0%	0	14%	9,369
	Direct Consumption	28 Gas Consumed in Process	0%	0	33%	214,596	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	7%	4,975
	Total		**100%**	**74,230**	**100%**	**642,782**	**100%**	**171,841**	**100%**	**59,807**	**100%**	**206,231**	**100%**	**19,416**	**100%**	**97,553**	**100%**	**5,268,741**	**100%**	**1,324,926**	**100%**	**68,615**

Economic Case 2020 Forecast Sales by Service Area and Sub Sector

	SOUTHERN INTERIOR		Agriculture		Chemical		Fabricated Metal		Food & Beverage		Mining		Miscellaneous Manufacturing		Non-Metal Manufacturing		Pulp and Paper		Wood Products		Other	
	END USE	TECHNOLOGY	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)
COMFORT HEATING	Boilers	1 Standard Efficiency Boiler	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		2 Near Condensing Boilers	0%	0	0%	0	0%	0	3%	9,634	3%	50,680	8%	1,567	0%	0	0%	4,218	0%	0	0%	0
		3 Condensing Boiler	0%	0	0%	0	0%	0	2%	5,643	2%	39,939	4%	695	0%	0	0%	1,283	0%	0	0%	0
	Air Heating	4 Standard Efficiency Air Handling Units and Unit Heaters	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		5 High-efficiency Air Handling Units and Unit heaters (Condensing)	10%	10,079	15%	6,005	21%	13,001	8%	28,060	0%	5,976	27%	5,243	20%	21,722	4%	42,370	2%	13,289	32%	9,349
		6 Radiant Tube Heating	8%	7,820	17%	7,105	40%	24,990	9%	31,492	1%	13,208	32%	6,064	24%	25,868	2%	27,004	3%	15,826	38%	11,164
PROCESS HEATING	Boilers	1 Standard Efficiency Boiler	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		2 Near Condensing Boiler	0%	0	28%	11,401	0%	0	28%	96,151	20%	397,775	4%	761	6%	6,057	29%	345,806	7%	41,360	9%	2,762
		3 Condensing Boiler	80%	79,324	11%	4,742	0%	0	19%	64,680	13%	262,207	1%	233	1%	1,571	6%	71,023	3%	17,297	4%	1,258
	Water Heaters	4 Tank-type Water Heating	1%	1,417	0%	0	0%	0	3%	9,392	0%	0	2%	474	0%	0	0%	0	0%	0	3%	771
		5 Instantaneous Water Heater	0%	216	0%	0	0%	0	2%	5,757	0%	0	3%	618	0%	0	0%	0	0%	0	2%	562
		6 Direct-fired Water Heating	0%	0	0%	0	0%	0	12%	42,049	0%	0	0%	0	0%	0	0%	0	5%	28,085	0%	0
	Ovens	7 Standard Efficiency Oven	0%	0	0%	0	0%	0	1%	4,943	0%	0	1%	128	1%	1,414	0%	0	0%	0	0%	0
		8 Efficient Oven	0%	0	0%	0	0%	0	12%	41,063	0%	0	6%	1,077	7%	7,926	0%	0	0%	0	0%	0
	Heat Treating	9 Standard Efficiency Heat Treating Furnace	0%	0	0%	0	3%	2,133	0%	0	0%	0	1%	120	0%	0	0%	0	0%	0	0%	0
		10 Heat Treating Furnace with Sequential Firing, High-velocity Burners	0%	0	0%	0	29%	18,259	0%	0	0%	0	5%	1,005	0%	0	0%	0	0%	0	0%	0
	Lumber Kiln	11 Standard Efficiency Kiln	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	12%	72,983	0%	0
		12 High-efficiency Kiln	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	55%	320,999	0%	0
	Veneer Dryers	13 Standard Efficiency Veneer Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	2%	11,039	0%	0
		14 Advanced Veneer Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	11%	64,029	0%	0
	Paper	15 Direct-fired Paper Drying	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	19%	217,666	0%	0	0%	0
	Pulp Lime Kilns	16 Standard Efficiency Pulp Lime Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	27%	318,822	0%	0	0%	0
		17 High-efficiency Pulp Lime Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	13%	147,312	0%	0	0%	0
	Cement Kilns	18 Standard Efficiency Cement Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	20%	21,267	0%	0	0%	0	0%	0
		19 High-efficiency Cement Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	14%	15,248	0%	0	0%	0	0%	0
	Ore Drying	20 Standard Efficiency Ore Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		21 High-efficiency Ore Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Coal Drying	22 Standard Efficiency Coal Dryer	0%	0	0%	0	0%	0	0%	0	55%	1,076,025	0%	0	0%	0	0%	0	0%	0	0%	0
		23 High-efficiency Coal Dryer (with centrifuge)	0%	0	0%	0	0%	0	0%	0	6%	108,388	0%	0	0%	0	0%	0	0%	0	0%	0
	Miscellaneous	24 Miscellaneous Standard Equipment	0%	0	0%	0	0%	0	0%	0	0%	0	3%	548	0%	0	0%	0	0%	0	0%	0
		25 Miscellaneous Efficient Equipment	0%	0	0%	0	0%	0	0%	0	0%	0	4%	715	0%	0	0%	0	0%	0	0%	0
	Laundry	26 Direct-fired Gas Laundry Dryers	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	3%	822
	Direct-fired	27 Direct-fired Heating	0%	0	29%	12,041	7%	4,365	0%	0	0%	0	0%	0	5%	5,614	0%	0	0%	0	3%	822
	Direct Consumption	28 Gas Consumed in Process	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	7%	2,056
	Total		**100%**	**98,855**	**100%**	**41,295**	**100%**	**62,748**	**100%**	**338,863**	**100%**	**1,954,200**	**100%**	**19,250**	**100%**	**106,688**	**100%**	**1,175,504**	**100%**	**584,906**	**100%**	**29,566**

Economic Case 2020 Forecast Sales by Service Area and Sub Sector

	VANCOUVER ISLAND		Agriculture		Chemical		Fabricated Metal		Food & Beverage		Mining		Miscellaneous Manufacturing		Non-Metal Manufacturing		Pulp and Paper		Wood Products		Other	
	END USE	TECHNOLOGY	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)
COMFORT HEATING	Boilers	1 Standard Efficiency Boiler	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		2 Near Condensing Boilers	0%	0	0%	0	0%	0	1%	976	0%	0	1%	106	0%	0	2%	150	0%	0	0%	0
		3 Condensing Boiler	0%	0	0%	0	0%	0	0%	572	0%	0	0%	47	0%	0	1%	41	0%	0	0%	0
	Air Heating	4 Standard Efficiency Air Handling Units and Unit Heaters	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		5 High-efficiency Air Handling Units and Unit heaters (Condensing)	2%	541	9%	12,490	16%	1,127	2%	2,129	0%	0	2%	356	46%	37,404	2%	132	0%	0	2%	2,143
		6 Radiant Tube Heating	2%	418	11%	14,660	31%	2,163	2%	2,323	0%	0	3%	410	54%	44,410	2%	151	0%	0	2%	2,544
PROCESS HEATING	Boilers	1 Standard Efficiency Boiler	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		2 Near Condensing Boiler	0%	0	10%	13,704	0%	0	39%	45,432	0%	0	13%	2,028	0%	0	40%	2,632	7%	8,050	19%	24,043
		3 Condensing Boiler	94%	22,501	4%	4,907	0%	0	31%	35,954	0%	0	4%	621	0%	0	12%	810	3%	3,366	14%	17,447
	Water Heaters	4 Tank-type Water Heating	2%	402	0%	0	0%	0	5%	5,318	0%	0	8%	1,263	0%	0	0%	0	0%	0	6%	7,820
		5 Instantaneous Water Heater	0%	61	0%	0	0%	0	3%	3,259	0%	0	10%	1,647	0%	0	0%	0	0%	0	6%	6,820
		6 Direct-fired Water Heating	0%	0	0%	0	0%	0	18%	21,540	0%	0	0%	0	0%	0	0%	0	5%	5,466	0%	0
	Ovens	7 Standard Efficiency Oven	0%	0	0%	0	0%	0	0%	0	0%	0	2%	340	0%	0	0%	0	0%	0	0%	0
		8 Efficient Oven	0%	0	0%	0	0%	0	0%	0	0%	0	18%	2,870	0%	0	0%	0	0%	0	0%	0
	Heat Treating	9 Standard Efficiency Heat Treating Furnace	0%	0	0%	0	5%	314	0%	0	0%	0	2%	321	0%	0	0%	0	0%	0	0%	0
		10 Heat Treating Furnace with Sequential Firing, High-velocity Burners	0%	0	0%	0	39%	2,687	0%	0	0%	0	17%	2,679	0%	0	0%	0	0%	0	0%	0
	Lumber Kiln	11 Standard Efficiency Kiln	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	13%	14,204	0%	0
		12 High-efficiency Kiln	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	58%	62,473	0%	0
	Veneer Dryers	13 Standard Efficiency Veneer Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	2%	2,148	0%	0
		14 Advanced Veneer Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	12%	12,461	0%	0
	Paper	15 Direct-fired Paper Drying	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	41%	2,681	0%	0	0%	0
	Pulp Lime Kilns	16 Standard Efficiency Pulp Lime Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		17 High-efficiency Pulp Lime Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Cement Kilns	18 Standard Efficiency Cement Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		19 High-efficiency Cement Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Ore Drying	20 Standard Efficiency Ore Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		21 High-efficiency Ore Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Coal Drying	22 Standard Efficiency Coal Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		23 High-efficiency Coal Dryer (with centrifuge)	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Miscellaneous	24 Miscellaneous Standard Equipment	0%	0	0%	0	0%	0	0%	0	0%	0	9%	1,461	0%	0	0%	0	0%	0	0%	0
		25 Miscellaneous Efficient Equipment	0%	0	0%	0	0%	0	0%	0	0%	0	12%	1,906	0%	0	0%	0	0%	0	0%	0
	Laundry	26 Direct-fired Gas Laundry Dryers	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	21%	26,054
	Direct-fired	27 Direct-fired Heating	0%	0	67%	93,651	9%	642	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	8%	10,422
	Direct Consumption	28 Gas Consumed in Process	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	21%	26,054
	Total		**100%**	**23,923**	**100%**	**139,412**	**100%**	**6,933**	**100%**	**117,503**	**0%**	**0**	**100%**	**16,056**	**100%**	**81,815**	**100%**	**6,598**	**100%**	**108,169**	**100%**	**123,348**

Economic Case 2020 Forecast Sales by Service Area and Sub Sector

	TOTAL SERVICE AREAS		Agriculture		Chemical		Fabricated Metal		Food & Beverage		Mining		Miscellaneous Manufacturing		Non-Metal Manufacturing		Pulp and Paper		Wood Products		Other	
	END USE	TECHNOLOGY	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)
COMFORT HEATING	Boilers	1 Standard Efficiency Boiler	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		2 Near Condensing Boilers	0%	0	0%	0	0%	0	2%	60,675	3%	61,650	2%	5,218	0%	0	0%	25,931	0%	0	0%	0
		3 Condensing Boiler	0%	0	0%	0	0%	0	1%	33,146	2%	45,663	1%	2,313	0%	0	0%	7,876	0%	0	0%	0
	Air Heating	4 Standard Efficiency Air Handling Units and Unit Heaters	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		5 High-efficiency Air Handling Units and Unit heaters (Condensing)	12%	322,796	2%	58,896	10%	113,319	3%	105,325	1%	17,980	5%	17,543	10%	140,119	3%	256,245	2%	49,630	20%	117,362
		6 Radiant Tube Heating	9%	249,487	4%	124,794	20%	221,247	4%	114,068	1%	31,712	79%	250,821	11%	166,473	2%	163,387	2%	59,080	24%	139,530
PROCESS HEATING	Boilers	1 Standard Efficiency Boiler	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		2 Near Condensing Boiler	0%	0	26%	772,248	5%	54,805	30%	920,651	20%	433,066	2%	5,783	2%	25,696	30%	2,234,629	7%	190,700	16%	95,283
		3 Condensing Boiler	78%	2,170,467	7%	213,764	1%	12,884	25%	768,405	13%	285,470	1%	1,772	0%	6,667	6%	463,746	3%	79,752	9%	53,668
	Water Heaters	4 Tank-type Water Heating	1%	36,825	0%	0	0%	0	3%	81,254	0%	0	1%	3,602	0%	0	0%	0	0%	0	4%	23,136
		5 Instantaneous Water Heater	0%	5,600	0%	0	0%	0	2%	49,801	0%	0	1%	4,698	0%	0	0%	0	0%	0	3%	16,524
		6 Direct-fired Water Heating	0%	0	0%	0	0%	0	18%	553,296	0%	0	0%	0	0%	0	0%	0	5%	129,490	0%	0
	Ovens	7 Standard Efficiency Oven	0%	0	0%	0	0%	0	1%	43,871	0%	0	0%	969	1%	15,631	0%	0	0%	0	0%	0
		8 Efficient Oven	0%	0	0%	0	0%	0	12%	374,807	0%	0	3%	8,183	5%	67,704	0%	0	0%	0	0%	0
	Heat Treating	9 Standard Efficiency Heat Treating Furnace	0%	0	0%	0	5%	56,326	0%	0	0%	0	0%	915	0%	0	0%	0	0%	0	0%	0
		10 Heat Treating Furnace with Sequential Firing, High-velocity Burners	0%	0	0%	0	45%	495,055	0%	0	0%	0	2%	7,640	0%	0	0%	0	0%	0	0%	0
	Lumber Kiln	11 Standard Efficiency Kiln	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	13%	336,504	0%	0
		12 High-efficiency Kiln	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	55%	1,480,038	0%	0
	Veneer Dryers	13 Standard Efficiency Veneer Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	2%	50,897	0%	0
		14 Advanced Veneer Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	11%	295,222	0%	0
	Paper	15 Direct-fired Paper Drying	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	19%	1,404,269	0%	0	0%	0
	Pulp Lime Kilns	16 Standard Efficiency Pulp Lime Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	26%	1,965,405	0%	0	0%	0
		17 High-efficiency Pulp Lime Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	12%	904,392	0%	0	0%	0
	Cement Kilns	18 Standard Efficiency Cement Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	29%	424,559	0%	0	0%	0	0%	0
		19 High-efficiency Cement Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	7%	97,752	0%	0	0%	0	0%	0
	Ore Drying	20 Standard Efficiency Ore Dryer	0%	0	0%	0	0%	0	0%	0	5%	102,471	0%	0	0%	0	0%	0	0%	0	0%	0
		21 High-efficiency Ore Dryer	0%	0	0%	0	0%	0	0%	0	0%	9,616	0%	0	0%	0	0%	0	0%	0	0%	0
	Coal Drying	22 Standard Efficiency Coal Dryer	0%	0	0%	0	0%	0	0%	0	49%	1,076,025	0%	0	0%	0	0%	0	0%	0	0%	0
		23 High-efficiency Coal Dryer (with centrifuge)	0%	0	0%	0	0%	0	0%	0	5%	108,388	0%	0	0%	0	0%	0	0%	0	0%	0
	Miscellaneous	24 Miscellaneous Standard Equipment	0%	0	0%	0	0%	0	0%	0	0%	0	1%	4,167	0%	0	0%	0	0%	0	0%	0
		25 Miscellaneous Efficient Equipment	0%	0	0%	0	0%	0	0%	0	0%	0	2%	5,434	0%	0	0%	0	0%	0	0%	0
	Laundry	26 Direct-fired Gas Laundry Dryers	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	9%	53,098
	Direct-fired	27 Direct-fired Heating	0%	0	30%	900,088	13%	140,683	0%	0	1%	11,228	0%	0	35%	512,767	0%	0	0%	0	5%	31,450
	Direct Consumption	28 Gas Consumed in Process	0%	0	31%	946,323	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	10%	60,177
	Total		**100%**	**2,785,175**	**100%**	**3,016,113**	**100%**	**1,094,319**	**100%**	**3,105,299**	**100%**	**2,183,270**	**100%**	**319,057**	**100%**	**1,457,367**	**100%**	**7,425,880**	**100%**	**2,671,313**	**100%**	**590,227**

Economic Case 2025 Forecast Sales by Service Area and Sub Sector

LOWER MAINLAND			Agriculture		Chemical		Fabricated Metal		Food & Beverage		Mining		Miscellaneous Manufacturing		Non-Metal Manufacturing		Pulp and Paper		Wood Products		Other	
	END USE	TECHNOLOGY	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)
COMFORT HEATING	Boilers	1 Standard Efficiency Boiler	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		2 Near Condensing Boilers	0%	0	0%	0	0%	0	2%	47,672	9%	1,992	1%	2,977	0%	0	0%	2,328	0%	0	0%	0
		3 Condensing Boiler	0%	0	0%	0	0%	0	1%	26,373	3%	701	1%	1,355	0%	0	0%	736	0%	0	0%	0
	Air Heating	4 Standard Efficiency Air Handling Units and Unit Heaters	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		5 High-efficiency Air Handling Units and Unit heaters (Condensing)	12%	304,833	1%	28,288	10%	83,040	3%	70,224	16%	3,541	4%	10,038	6%	68,363	2%	23,341	1%	6,224	24%	83,442
		6 Radiant Tube Heating	9%	237,690	2%	33,506	20%	162,846	3%	75,563	23%	5,355	86%	214,313	7%	81,731	2%	14,995	1%	7,441	28%	99,759
PROCESS HEATING	Boilers	1 Standard Efficiency Boiler	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		2 Near Condensing Boiler	0%	0	26%	575,783	7%	53,287	29%	767,488	0%	0	1%	2,714	2%	17,957	35%	341,614	7%	47,325	17%	58,425
		3 Condensing Boiler	78%	2,024,951	9%	192,236	2%	12,496	25%	662,674	0%	0	0%	869	0%	4,870	7%	69,846	3%	20,389	9%	30,922
	Water Heaters	4 Tank-type Water Heating	1%	31,312	0%	0	0%	0	2%	59,958	0%	0	1%	1,583	0%	0	0%	0	0%	0	3%	11,223
		5 Instantaneous Water Heater	0%	7,730	0%	0	0%	0	2%	44,707	0%	0	1%	2,364	0%	0	0%	0	0%	0	2%	8,380
		6 Direct-fired Water Heating	0%	0	0%	0	0%	0	19%	482,864	0%	0	0%	0	0%	0	0%	0	5%	32,162	0%	0
	Ovens	7 Standard Efficiency Oven	0%	0	0%	0	0%	0	1%	21,845	0%	0	0%	288	1%	8,673	0%	0	0%	0	0%	0
		8 Efficient Oven	0%	0	0%	0	0%	0	13%	342,942	0%	0	2%	4,036	5%	60,860	0%	0	0%	0	0%	0
	Heat Treating	9 Standard Efficiency Heat Treating Furnace	0%	0	0%	0	3%	23,093	0%	0	0%	0	0%	324	0%	0	0%	0	0%	0	0%	0
		10 Heat Treating Furnace with Sequential Firing, High-velocity Burners	0%	0	0%	0	47%	381,838	0%	0	0%	0	2%	3,753	0%	0	0%	0	0%	0	0%	0
	Lumber Kiln	11 Standard Efficiency Kiln	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	7%	47,751	0%	0
		12 High-efficiency Kiln	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	62%	408,924	0%	0
	Veneer Dryers	13 Standard Efficiency Veneer Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	1%	6,637	0%	0
		14 Advanced Veneer Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	12%	80,014	0%	0
	Paper	15 Direct-fired Paper Drying	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	22%	210,663	0%	0	0%	0
	Pulp Lime Kilns	16 Standard Efficiency Pulp Lime Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	21%	207,439	0%	0	0%	0
		17 High-efficiency Pulp Lime Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	11%	105,723	0%	0	0%	0
	Cement Kilns	18 Standard Efficiency Cement Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	30%	340,491	0%	0	0%	0	0%	0
		19 High-efficiency Cement Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	8%	91,977	0%	0	0%	0	0%	0
	Ore Drying	20 Standard Efficiency Ore Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		21 High-efficiency Ore Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Coal Drying	22 Standard Efficiency Coal Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		23 High-efficiency Coal Dryer (with centrifuge)	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Miscellaneous	24 Miscellaneous Standard Equipment	0%	0	0%	0	0%	0	0%	0	0%	0	1%	1,817	0%	0	0%	0	0%	0	0%	0
		25 Miscellaneous Efficient Equipment	0%	0	0%	0	0%	0	0%	0	0%	0	1%	2,714	0%	0	0%	0	0%	0	0%	0
	Laundry	26 Direct-fired Gas Laundry Dryers	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	7%	23,044
	Direct-fired	27 Direct-fired Heating	0%	0	29%	633,726	12%	99,290	0%	0	49%	11,228	0%	0	40%	443,708	0%	0	0%	0	3%	10,305
	Direct Consumption	28 Gas Consumed in Process	0%	0	33%	731,727	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	7%	25,763
	Total		**100%**	**2,606,516**	**100%**	**2,195,266**	**100%**	**815,890**	**100%**	**2,602,309**	**100%**	**22,817**	**100%**	**249,147**	**100%**	**1,118,630**	**100%**	**976,684**	**100%**	**656,867**	**100%**	**351,264**

Economic Case 2025 Forecast Sales by Service Area and Sub Sector

NORTHERN INTERIOR

	END USE	TECHNOLOGY	Agriculture		Chemical		Fabricated Metal		Food & Beverage		Mining		Miscellaneous Manufacturing		Non-Metal Manufacturing		Pulp and Paper		Wood Products		Other	
			Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)
COMFORT HEATING	Boilers	1 Standard Efficiency Boiler	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		2 Near Condensing Boilers	0%	0	0%	0	0%	0	4%	2,219	4%	8,936	2%	381	0%	0	0%	19,107	0%	0	0%	0
		3 Condensing Boiler	0%	0	0%	0	0%	0	2%	1,339	2%	5,137	1%	173	0%	0	0%	6,033	0%	0	0%	0
	Air Heating	4 Standard Efficiency Air Handling Units and Unit Heaters	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		5 High-efficiency Air Handling Units and Unit heaters (Condensing)	18%	13,944	2%	12,177	7%	10,983	8%	4,817	4%	8,398	7%	1,275	9%	8,488	4%	189,648	2%	30,051	26%	17,026
		6 Radiant Tube Heating	14%	10,909	11%	69,436	13%	21,261	9%	5,337	6%	13,089	85%	15,600	11%	10,172	2%	122,848	3%	36,016	31%	20,452

	END USE	TECHNOLOGY	Agriculture Market Share	Agriculture Total Sales (GJ)	Chemical Market Share	Chemical Total Sales (GJ)	Fabricated Metal Market Share	Fabricated Metal Total Sales (GJ)	Food & Beverage Market Share	Food & Beverage Total Sales (GJ)	Mining Market Share	Mining Total Sales (GJ)	Misc. Manufacturing Market Share	Misc. Manufacturing Total Sales (GJ)	Non-Metal Manufacturing Market Share	Non-Metal Manufacturing Total Sales (GJ)	Pulp and Paper Market Share	Pulp and Paper Total Sales (GJ)	Wood Products Market Share	Wood Products Total Sales (GJ)	Other Market Share	Other Total Sales (GJ)
PROCESS HEATING	Boilers	1 Standard Efficiency Boiler	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		2 Near Condensing Boiler	0%	0	26%	166,841	0%	0	24%	14,279	17%	35,088	1%	117	1%	624	30%	1,573,281	7%	93,143	10%	6,318
		3 Condensing Boiler	66%	50,715	2%	15,226	0%	0	22%	13,176	11%	23,425	0%	37	0%	169	6%	302,064	3%	40,129	5%	2,961
	Water Heaters	4 Tank-type Water Heating	1%	854	0%	0	0%	0	3%	1,985	0%	0	0%	68	0%	0	0%	0	0%	0	3%	1,653
		5 Instantaneous Water Heater	0%	211	0%	0	0%	0	2%	1,480	0%	0	1%	102	0%	0	0%	0	0%	0	2%	1,438
		6 Direct-fired Water Heating	0%	0	0%	0	0%	0	12%	7,367	0%	0	0%	0	0%	0	0%	0	5%	63,301	0%	0
	Ovens	7 Standard Efficiency Oven	0%	0	0%	0	0%	0	1%	504	0%	0	0%	12	0%	100	0%	0	0%	0	0%	0
		8 Efficient Oven	0%	0	0%	0	0%	0	13%	7,575	0%	0	1%	174	1%	868	0%	0	0%	0	0%	0
	Heat Treating	9 Standard Efficiency Heat Treating Furnace	0%	0	0%	0	4%	6,282	0%	0	0%	0	0%	14	0%	0	0%	0	0%	0	0%	0
		10 Heat Treating Furnace with Sequential Firing, High-velocity Burners	0%	0	0%	0	59%	96,232	0%	0	0%	0	1%	161	0%	0	0%	0	0%	0	0%	0
	Lumber Kiln	11 Standard Efficiency Kiln	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	7%	93,982	0%	0
		12 High-efficiency Kiln	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	60%	804,832	0%	0
	Veneer Dryers	13 Standard Efficiency Veneer Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	1%	13,062	0%	0
		14 Advanced Veneer Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	12%	157,482	0%	0
	Paper	15 Direct-fired Paper Drying	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	19%	981,899	0%	0	0%	0
	Pulp Lime Kilns	16 Standard Efficiency Pulp Lime Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	26%	1,367,732	0%	0	0%	0
		17 High-efficiency Pulp Lime Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	14%	724,623	0%	0	0%	0
	Cement Kilns	18 Standard Efficiency Cement Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	28%	26,360	0%	0	0%	0	0%	0
		19 High-efficiency Cement Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	6%	5,448	0%	0	0%	0	0%	0
	Ore Drying	20 Standard Efficiency Ore Dryer	0%	0	0%	0	0%	0	0%	0	47%	98,016	0%	0	0%	0	0%	0	0%	0	0%	0
		21 High-efficiency Ore Dryer	0%	0	0%	0	0%	0	0%	0	7%	14,424	0%	0	0%	0	0%	0	0%	0	0%	0
	Coal Drying	22 Standard Efficiency Coal Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		23 High-efficiency Coal Dryer (with centrifuge)	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Miscellaneous	24 Miscellaneous Standard Equipment	0%	0	0%	0	0%	0	0%	0	0%	0	0%	78	0%	0	0%	0	0%	0	0%	0
		25 Miscellaneous Efficient Equipment	0%	0	0%	0	0%	0	0%	0	0%	0	1%	117	0%	0	0%	0	0%	0	0%	0
	Laundry	26 Direct-fired Gas Laundry Dryers	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	3%	1,893
	Direct-fired	27 Direct-fired Heating	0%	0	26%	164,549	18%	29,737	0%	0	0%	0	0%	0	44%	40,945	0%	0	0%	0	14%	8,910
	Direct Consumption	28 Gas Consumed in Process	0%	0	33%	214,596	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	7%	4,732
Total			**100%**	**76,632**	**100%**	**642,826**	**100%**	**164,494**	**100%**	**60,078**	**100%**	**206,512**	**100%**	**18,309**	**100%**	**93,174**	**100%**	**5,287,235**	**100%**	**1,331,999**	**100%**	**65,383**

Economic Case 2025 Forecast Sales by Service Area and Sub Sector

	SOUTHERN INTERIOR		Agriculture		Chemical		Fabricated Metal		Food & Beverage		Mining		Miscellaneous Manufacturing		Non-Metal Manufacturing		Pulp and Paper		Wood Products		Other	
	END USE	TECHNOLOGY	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)
COMFORT HEATING	Boilers	1 Standard Efficiency Boiler	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		2 Near Condensing Boilers	0%	0	0%	0	0%	0	3%	9,597	3%	50,491	8%	1,485	0%	0	0%	4,195	0%	0	0%	0
		3 Condensing Boiler	0%	0	0%	0	0%	0	2%	5,789	2%	40,216	4%	676	0%	0	0%	1,327	0%	0	0%	0
	Air Heating	4 Standard Efficiency Air Handling Units and Unit Heaters	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		5 High-efficiency Air Handling Units and Unit heaters (Condensing)	10%	9,999	14%	6,020	21%	12,331	8%	28,065	0%	5,963	27%	4,972	20%	20,622	4%	42,228	2%	13,267	32%	8,881
		6 Radiant Tube Heating	8%	7,823	17%	7,178	40%	23,715	9%	31,738	1%	13,167	32%	5,781	24%	24,715	2%	27,325	3%	15,900	38%	10,667
PROCESS HEATING	Boilers	1 Standard Efficiency Boiler	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		2 Near Condensing Boiler	0%	0	27%	11,337	0%	0	28%	96,267	20%	395,488	4%	720	6%	5,731	30%	351,153	7%	41,119	9%	2,611
		3 Condensing Boiler	81%	81,169	12%	4,931	0%	0	19%	65,408	13%	264,031	1%	230	2%	1,554	6%	67,465	3%	17,716	4%	1,224
	Water Heaters	4 Tank-type Water Heating	1%	1,313	0%	0	0%	0	3%	8,743	0%	0	2%	420	0%	0	0%	0	0%	0	2%	683
		5 Instantaneous Water Heater	0%	324	0%	0	0%	0	2%	6,519	0%	0	3%	627	0%	0	0%	0	0%	0	2%	594
		6 Direct-fired Water Heating	0%	0	0%	0	0%	0	12%	42,098	0%	0	0%	0	0%	0	0%	0	5%	27,945	0%	0
	Ovens	7 Standard Efficiency Oven	0%	0	0%	0	0%	0	1%	2,865	0%	0	0%	76	1%	917	0%	0	0%	0	0%	0
		8 Efficient Oven	0%	0	0%	0	0%	0	13%	43,167	0%	0	6%	1,070	8%	7,980	0%	0	0%	0	0%	0
	Heat Treating	9 Standard Efficiency Heat Treating Furnace	0%	0	0%	0	2%	1,144	0%	0	0%	0	0%	86	0%	0	0%	0	0%	0	0%	0
		10 Heat Treating Furnace with Sequential Firing, High-velocity Burners	0%	0	0%	0	31%	18,460	0%	0	0%	0	5%	995	0%	0	0%	0	0%	0	0%	0
	Lumber Kiln	11 Standard Efficiency Kiln	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	7%	41,490	0%	0
		12 High-efficiency Kiln	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	60%	355,304	0%	0
	Veneer Dryers	13 Standard Efficiency Veneer Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	1%	5,766	0%	0
		14 Advanced Veneer Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	12%	69,522	0%	0
	Paper	15 Direct-fired Paper Drying	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	19%	219,388	0%	0	0%	0
	Pulp Lime Kilns	16 Standard Efficiency Pulp Lime Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	26%	304,961	0%	0	0%	0
		17 High-efficiency Pulp Lime Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	14%	161,568	0%	0	0%	0
	Cement Kilns	18 Standard Efficiency Cement Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	19%	19,346	0%	0	0%	0	0%	0
		19 High-efficiency Cement Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	15%	15,501	0%	0	0%	0	0%	0
	Ore Drying	20 Standard Efficiency Ore Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		21 High-efficiency Ore Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Coal Drying	22 Standard Efficiency Coal Dryer	0%	0	0%	0	0%	0	0%	0	52%	1,029,241	0%	0	0%	0	0%	0	0%	0	0%	0
		23 High-efficiency Coal Dryer (with centrifuge)	0%	0	0%	0	0%	0	0%	0	8%	162,583	0%	0	0%	0	0%	0	0%	0	0%	0
	Miscellaneous	24 Miscellaneous Standard Equipment	0%	0	0%	0	0%	0	0%	0	0%	0	3%	482	0%	0	0%	0	0%	0	0%	0
		25 Miscellaneous Efficient Equipment	0%	0	0%	0	0%	0	0%	0	0%	0	4%	720	0%	0	0%	0	0%	0	0%	0
	Laundry	26 Direct-fired Gas Laundry Dryers	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	3%	782
	Direct-fired	27 Direct-fired Heating	0%	0	29%	12,100	7%	4,151	0%	0	0%	0	0%	0	5%	5,365	0%	0	0%	0	3%	782
	Direct Consumption	28 Gas Consumed in Process	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	7%	1,955
	Total		**100%**	**100,628**	**100%**	**41,566**	**100%**	**59,800**	**100%**	**340,257**	**100%**	**1,961,180**	**100%**	**18,339**	**100%**	**101,732**	**100%**	**1,179,608**	**100%**	**588,028**	**100%**	**28,179**

Economic Case 2025 Forecast Sales by Service Area and Sub Sector

VANCOUVER ISLAND

	END USE	TECHNOLOGY	Agriculture		Chemical		Fabricated Metal		Food & Beverage		Mining		Miscellaneous Manufacturing		Non-Metal Manufacturing		Pulp and Paper		Wood Products		Other	
			Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)
COMFORT HEATING	Boilers	1 Standard Efficiency Boiler	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		2 Near Condensing Boilers	0%	0	0%	0	0%	0	1%	972	0%	0	1%	100	0%	0	2%	150	0%	0	0%	0
		3 Condensing Boiler	0%	0	0%	0	0%	0	0%	587	0%	0	0%	46	0%	0	1%	42	0%	0	0%	0
	Air Heating	4 Standard Efficiency Air Handling Units and Unit Heaters	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		5 High-efficiency Air Handling Units and Unit heaters (Condensing)	2%	536	9%	12,506	16%	1,068	2%	2,126	0%	0	2%	338	46%	35,489	2%	132	0%	0	2%	2,033
		6 Radiant Tube Heating	2%	418	11%	14,812	31%	2,052	2%	2,342	0%	0	3%	391	54%	42,429	2%	152	0%	0	2%	2,431
PROCESS HEATING	Boilers	1 Standard Efficiency Boiler	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		2 Near Condensing Boiler	0%	0	10%	13,627	0%	0	39%	45,483	0%	0	13%	1,917	0%	0	36%	2,421	7%	8,003	19%	22,732
		3 Condensing Boiler	94%	22,463	4%	5,102	0%	0	31%	36,302	0%	0	4%	614	0%	0	11%	766	3%	3,448	14%	16,759
	Water Heaters	4 Tank-type Water Heating	2%	373	0%	0	0%	0	4%	4,950	0%	0	7%	1,118	0%	0	0%	0	0%	0	6%	6,923
		5 Instantaneous Water Heater	0%	92	0%	0	0%	0	3%	3,691	0%	0	11%	1,670	0%	0	0%	0	0%	0	6%	7,104
		6 Direct-fired Water Heating	0%	0	0%	0	0%	0	18%	21,656	0%	0	0%	0	0%	0	0%	0	5%	5,439	0%	0
	Ovens	7 Standard Efficiency Oven	0%	0	0%	0	0%	0	0%	0	0%	0	1%	204	0%	0	0%	0	0%	0	0%	0
		8 Efficient Oven	0%	0	0%	0	0%	0	0%	0	0%	0	19%	2,851	0%	0	0%	0	0%	0	0%	0
	Heat Treating	9 Standard Efficiency Heat Treating Furnace	0%	0	0%	0	3%	168	0%	0	0%	0	1%	229	0%	0	0%	0	0%	0	0%	0
		10 Heat Treating Furnace with Sequential Firing, High-velocity Burners	0%	0	0%	0	41%	2,716	0%	0	0%	0	17%	2,652	0%	0	0%	0	0%	0	0%	0
	Lumber Kiln	11 Standard Efficiency Kiln	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	7%	8,075	0%	0
		12 High-efficiency Kiln	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	64%	69,150	0%	0
	Veneer Dryers	13 Standard Efficiency Veneer Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	1%	1,122	0%	0
		14 Advanced Veneer Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	12%	13,531	0%	0
	Paper	15 Direct-fired Paper Drying	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	45%	3,051	0%	0	0%	0
	Pulp Lime Kilns	16 Standard Efficiency Pulp Lime Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		17 High-efficiency Pulp Lime Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Cement Kilns	18 Standard Efficiency Cement Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		19 High-efficiency Cement Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Ore Drying	20 Standard Efficiency Ore Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		21 High-efficiency Ore Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Coal Drying	22 Standard Efficiency Coal Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		23 High-efficiency Coal Dryer (with centrifuge)	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Miscellaneous	24 Miscellaneous Standard Equipment	0%	0	0%	0	0%	0	0%	0	0%	0	8%	1,284	0%	0	0%	0	0%	0	0%	0
		25 Miscellaneous Efficient Equipment	0%	0	0%	0	0%	0	0%	0	0%	0	13%	1,918	0%	0	0%	0	0%	0	0%	0
	Laundry	26 Direct-fired Gas Laundry Dryers	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	21%	24,777
	Direct-fired	27 Direct-fired Heating	0%	0	67%	94,109	9%	611	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	8%	9,911
	Direct Consumption	28 Gas Consumed in Process	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	21%	24,777
	Total		**100%**	**23,882**	**100%**	**140,156**	**100%**	**6,615**	**100%**	**118,109**	**0%**	**0**	**100%**	**15,332**	**100%**	**77,918**	**100%**	**6,714**	**100%**	**108,766**	**100%**	**117,448**

Economic Case 2025 Forecast Sales by Service Area and Sub Sector

	TOTAL SERVICE AREAS		Agriculture		Chemical		Fabricated Metal		Food & Beverage		Mining		Miscellaneous Manufacturing		Non-Metal Manufacturing		Pulp and Paper		Wood Products		Other	
	END USE	TECHNOLOGY	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)
COMFORT HEATING	Boilers	1 Standard Efficiency Boiler	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		2 Near Condensing Boilers	0%	0	0%	0	0%	0	2%	60,461	3%	61,419	2%	4,943	0%	0	0%	25,779	0%	0	0%	0
		3 Condensing Boiler	0%	0	0%	0	0%	0	1%	34,088	2%	46,054	1%	2,249	0%	0	0%	8,138	0%	0	0%	0
	Air Heating	4 Standard Efficiency Air Handling Units and Unit Heaters	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		5 High-efficiency Air Handling Units and Unit heaters (Condensing)	12%	329,312	2%	58,991	10%	107,422	3%	105,233	1%	17,902	6%	16,622	10%	132,962	3%	255,349	2%	49,542	20%	111,383
		6 Radiant Tube Heating	9%	256,839	4%	124,932	20%	209,873	4%	114,980	1%	31,610	78%	236,085	11%	159,048	2%	165,320	2%	59,356	24%	133,309
PROCESS HEATING	Boilers	1 Standard Efficiency Boiler	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		2 Near Condensing Boiler	0%	0	25%	767,588	5%	53,287	30%	923,517	20%	430,576	2%	5,467	2%	24,311	30%	2,268,469	7%	189,590	16%	90,086
		3 Condensing Boiler	78%	2,179,298	7%	217,495	1%	12,496	25%	777,560	13%	287,456	1%	1,751	0%	6,593	6%	440,140	3%	81,682	9%	51,866
	Water Heaters	4 Tank-type Water Heating	1%	33,852	0%	0	0%	0	2%	75,636	0%	0	1%	3,189	0%	0	0%	0	0%	0	4%	20,481
		5 Instantaneous Water Heater	0%	8,357	0%	0	0%	0	2%	56,397	0%	0	2%	4,763	0%	0	0%	0	0%	0	3%	17,517
		6 Direct-fired Water Heating	0%	0	0%	0	0%	0	18%	553,984	0%	0	0%	0	0%	0	0%	0	5%	128,846	0%	0
	Ovens	7 Standard Efficiency Oven	0%	0	0%	0	0%	0	1%	25,214	0%	0	0%	581	1%	9,690	0%	0	0%	0	0%	0
		8 Efficient Oven	0%	0	0%	0	0%	0	13%	393,684	0%	0	3%	8,131	5%	69,709	0%	0	0%	0	0%	0
	Heat Treating	9 Standard Efficiency Heat Treating Furnace	0%	0	0%	0	3%	30,687	0%	0	0%	0	0%	653	0%	0	0%	0	0%	0	0%	0
		10 Heat Treating Furnace with Sequential Firing, High-velocity Burners	0%	0	0%	0	48%	499,245	0%	0	0%	0	3%	7,562	0%	0	0%	0	0%	0	0%	0
	Lumber Kiln	11 Standard Efficiency Kiln	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	7%	191,298	0%	0
		12 High-efficiency Kiln	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	61%	1,638,210	0%	0
	Veneer Dryers	13 Standard Efficiency Veneer Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	1%	26,587	0%	0
		14 Advanced Veneer Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	12%	320,549	0%	0
	Paper	15 Direct-fired Paper Drying	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	19%	1,415,001	0%	0	0%	0
	Pulp Lime Kilns	16 Standard Efficiency Pulp Lime Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	25%	1,880,132	0%	0	0%	0
		17 High-efficiency Pulp Lime Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	13%	991,914	0%	0	0%	0
	Cement Kilns	18 Standard Efficiency Cement Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	28%	386,197	0%	0	0%	0	0%	0
		19 High-efficiency Cement Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	8%	112,926	0%	0	0%	0	0%	0
	Ore Drying	20 Standard Efficiency Ore Dryer	0%	0	0%	0	0%	0	0%	0	4%	98,016	0%	0	0%	0	0%	0	0%	0	0%	0
		21 High-efficiency Ore Dryer	0%	0	0%	0	0%	0	0%	0	1%	14,424	0%	0	0%	0	0%	0	0%	0	0%	0
	Coal Drying	22 Standard Efficiency Coal Dryer	0%	0	0%	0	0%	0	0%	0	47%	1,029,241	0%	0	0%	0	0%	0	0%	0	0%	0
		23 High-efficiency Coal Dryer (with centrifuge)	0%	0	0%	0	0%	0	0%	0	7%	162,583	0%	0	0%	0	0%	0	0%	0	0%	0
	Miscellaneous	24 Miscellaneous Standard Equipment	0%	0	0%	0	0%	0	0%	0	0%	0	1%	3,661	0%	0	0%	0	0%	0	0%	0
		25 Miscellaneous Efficient Equipment	0%	0	0%	0	0%	0	0%	0	0%	0	2%	5,469	0%	0	0%	0	0%	0	0%	0
	Laundry	26 Direct-fired Gas Laundry Dryers	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	9%	50,496
	Direct-fired	27 Direct-fired Heating	0%	0	30%	904,484	13%	133,788	0%	0	1%	11,228	0%	0	35%	490,018	0%	0	0%	0	5%	29,908
	Direct Consumption	28 Gas Consumed in Process	0%	0	31%	946,323	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	10%	57,227
	Total		**100%**	**2,807,658**	**100%**	**3,019,814**	**100%**	**1,046,800**	**100%**	**3,120,753**	**100%**	**2,190,509**	**100%**	**301,127**	**100%**	**1,391,454**	**100%**	**7,450,241**	**100%**	**2,685,660**	**100%**	**562,273**

Economic Case 2030 Forecast Sales by Service Area and Sub Sector

	LOWER MAINLAND		Agriculture		Chemical		Fabricated Metal		Food & Beverage		Mining		Miscellaneous Manufacturing		Non-Metal Manufacturing		Pulp and Paper		Wood Products		Other	
	END USE	TECHNOLOGY	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)
COMFORT HEATING	Boilers	1 Standard Efficiency Boiler	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		2 Near Condensing Boilers	0%	0	0%	0	0%	0	2%	47,488	9%	1,983	1%	2,820	0%	0	0%	2,315	0%	0	0%	0
		3 Condensing Boiler	0%	0	0%	0	0%	0	1%	27,100	3%	728	1%	1,316	0%	0	0%	759	0%	0	0%	0
	Air Heating	4 Standard Efficiency Air Handling Units and Unit Heaters	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		5 High-efficiency Air Handling Units and Unit heaters (Condensing)	12%	311,215	1%	28,330	10%	78,739	3%	70,151	15%	3,521	4%	9,511	6%	64,886	2%	23,246	1%	6,212	24%	79,198
		6 Radiant Tube Heating	9%	244,640	2%	33,822	20%	154,451	3%	76,113	23%	5,335	86%	201,720	7%	78,044	2%	15,161	1%	7,472	28%	95,259
PROCESS HEATING	Boilers	1 Standard Efficiency Boiler	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		2 Near Condensing Boiler	0%	0	26%	572,256	7%	51,772	29%	769,977	0%	0	1%	2,565	2%	16,987	35%	345,978	7%	47,045	17%	55,233
		3 Condensing Boiler	77%	2,026,047	9%	194,918	2%	12,112	26%	670,122	0%	0	0%	857	0%	4,804	7%	65,747	3%	20,857	9%	29,930
	Water Heaters	4 Tank-type Water Heating	1%	28,583	0%	0	0%	0	2%	55,431	0%	0	1%	1,392	0%	0	0%	0	0%	0	3%	9,867
		5 Instantaneous Water Heater	0%	10,253	0%	0	0%	0	2%	50,009	0%	0	1%	2,390	0%	0	0%	0	0%	0	3%	8,913
		6 Direct-fired Water Heating	0%	0	0%	0	0%	0	18%	483,372	0%	0	0%	0	0%	0	0%	0	5%	32,011	0%	0
	Ovens	7 Standard Efficiency Oven	0%	0	0%	0	0%	0	0%	5,687	0%	0	0%	114	0%	3,786	0%	0	0%	0	0%	0
		8 Efficient Oven	0%	0	0%	0	0%	0	14%	359,317	0%	0	2%	4,002	6%	62,466	0%	0	0%	0	0%	0
	Heat Treating	9 Standard Efficiency Heat Treating Furnace	0%	0	0%	0	1%	5,770	0%	0	0%	0	0%	202	0%	0	0%	0	0%	0	0%	0
		10 Heat Treating Furnace with Sequential Firing, High-velocity Burners	0%	0	0%	0	49%	383,054	0%	0	0%	0	2%	3,709	0%	0	0%	0	0%	0	0%	0
	Lumber Kiln	11 Standard Efficiency Kiln	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	2%	12,153	0%	0
		12 High-efficiency Kiln	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	68%	448,031	0%	0
	Veneer Dryers	13 Standard Efficiency Veneer Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	673	0%	0
		14 Advanced Veneer Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	13%	86,274	0%	0
	Paper	15 Direct-fired Paper Drying	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	22%	211,782	0%	0	0%	0
	Pulp Lime Kilns	16 Standard Efficiency Pulp Lime Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	20%	198,176	0%	0	0%	0
		17 High-efficiency Pulp Lime Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	12%	115,051	0%	0	0%	0
	Cement Kilns	18 Standard Efficiency Cement Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	29%	309,085	0%	0	0%	0	0%	0
		19 High-efficiency Cement Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	10%	104,208	0%	0	0%	0	0%	0
	Ore Drying	20 Standard Efficiency Ore Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		21 High-efficiency Ore Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Coal Drying	22 Standard Efficiency Coal Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		23 High-efficiency Coal Dryer (with centrifuge)	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Miscellaneous	24 Miscellaneous Standard Equipment	0%	0	0%	0	0%	0	0%	0	0%	0	1%	1,586	0%	0	0%	0	0%	0	0%	0
		25 Miscellaneous Efficient Equipment	0%	0	0%	0	0%	0	0%	0	0%	0	1%	2,724	0%	0	0%	0	0%	0	0%	0
	Laundry	26 Direct-fired Gas Laundry Dryers	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	7%	21,914
	Direct-fired	27 Direct-fired Heating	0%	0	29%	636,634	12%	94,424	0%	0	49%	11,228	0%	0	40%	423,898	0%	0	0%	0	3%	9,800
	Direct Consumption	28 Gas Consumed in Process	0%	0	33%	731,727	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	7%	24,501
	Total		**100%**	**2,620,737**	**100%**	**2,197,688**	**100%**	**780,322**	**100%**	**2,614,767**	**100%**	**22,795**	**100%**	**234,907**	**100%**	**1,068,166**	**100%**	**978,215**	**100%**	**660,727**	**100%**	**334,616**

Economic Case 2030 Forecast Sales by Service Area and Sub Sector

NORTHERN INTERIOR

	END USE	TECHNOLOGY	Agriculture		Chemical		Fabricated Metal		Food & Beverage		Mining		Miscellaneous Manufacturing		Non-Metal Manufacturing		Pulp and Paper		Wood Products		Other	
			Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)
COMFORT HEATING	Boilers	1 Standard Efficiency Boiler	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		2 Near Condensing Boilers	0%	0	0%	0	0%	0	4%	2,210	4%	8,900	2%	361	0%	0	0%	18,988	0%	0	0%	0
		3 Condensing Boiler	0%	0	0%	0	0%	0	2%	1,371	3%	5,222	1%	168	0%	0	0%	6,220	0%	0	0%	0
	Air Heating	4 Standard Efficiency Air Handling Units and Unit Heaters	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		5 High-efficiency Air Handling Units and Unit heaters (Condensing)	18%	13,840	2%	12,208	7%	10,420	8%	4,818	4%	8,359	7%	1,209	9%	8,060	4%	189,064	2%	30,009	26%	16,177
		6 Radiant Tube Heating	14%	10,908	11%	69,018	13%	20,173	9%	5,376	6%	13,048	85%	14,691	11%	9,714	2%	124,167	3%	36,166	31%	19,532
PROCESS HEATING	Boilers	1 Standard Efficiency Boiler	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		2 Near Condensing Boiler	0%	0	26%	165,933	0%	0	24%	14,316	17%	34,887	1%	110	1%	590	30%	1,596,956	7%	92,593	10%	5,973
		3 Condensing Boiler	67%	52,841	2%	15,791	0%	0	22%	13,294	11%	23,584	0%	37	0%	167	5%	285,889	3%	41,050	5%	2,879
	Water Heaters	4 Tank-type Water Heating	1%	786	0%	0	0%	0	3%	1,835	0%	0	0%	60	0%	0	0%	0	0%	0	2%	1,453
		5 Instantaneous Water Heater	0%	282	0%	0	0%	0	3%	1,655	0%	0	1%	103	0%	0	0%	0	0%	0	2%	1,508
		6 Direct-fired Water Heating	0%	0	0%	0	0%	0	12%	7,374	0%	0	0%	0	0%	0	0%	0	5%	63,002	0%	0
	Ovens	7 Standard Efficiency Oven	0%	0	0%	0	0%	0	0%	141	0%	0	0%	5	0%	51	0%	0	0%	0	0%	0
		8 Efficient Oven	0%	0	0%	0	0%	0	13%	7,943	0%	0	1%	172	1%	871	0%	0	0%	0	0%	0
	Heat Treating	9 Standard Efficiency Heat Treating Furnace	0%	0	0%	0	1%	1,280	0%	0	0%	0	0%	9	0%	0	0%	0	0%	0	0%	0
		10 Heat Treating Furnace with Sequential Firing, High-velocity Burners	0%	0	0%	0	62%	97,241	0%	0	0%	0	1%	160	0%	0	0%	0	0%	0	0%	0
	Lumber Kiln	11 Standard Efficiency Kiln	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	2%	23,919	0%	0
		12 High-efficiency Kiln	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	66%	881,801	0%	0
	Veneer Dryers	13 Standard Efficiency Veneer Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	1,325	0%	0
		14 Advanced Veneer Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	13%	169,802	0%	0
	Paper	15 Direct-fired Paper Drying	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	19%	989,425	0%	0	0%	0
	Pulp Lime Kilns	16 Standard Efficiency Pulp Lime Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	25%	1,305,562	0%	0	0%	0
		17 High-efficiency Pulp Lime Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	15%	788,561	0%	0	0%	0
	Cement Kilns	18 Standard Efficiency Cement Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	27%	23,929	0%	0	0%	0	0%	0
		19 High-efficiency Cement Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	7%	6,477	0%	0	0%	0	0%	0
	Ore Drying	20 Standard Efficiency Ore Dryer	0%	0	0%	0	0%	0	0%	0	45%	93,561	0%	0	0%	0	0%	0	0%	0	0%	0
		21 High-efficiency Ore Dryer	0%	0	0%	0	0%	0	0%	0	9%	19,233	0%	0	0%	0	0%	0	0%	0	0%	0
	Coal Drying	22 Standard Efficiency Coal Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		23 High-efficiency Coal Dryer (with centrifuge)	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Miscellaneous	24 Miscellaneous Standard Equipment	0%	0	0%	0	0%	0	0%	0	0%	0	0%	68	0%	0	0%	0	0%	0	0%	0
		25 Miscellaneous Efficient Equipment	0%	0	0%	0	0%	0	0%	0	0%	0	1%	117	0%	0	0%	0	0%	0	0%	0
	Laundry	26 Direct-fired Gas Laundry Dryers	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	3%	1,800
	Direct-fired	27 Direct-fired Heating	0%	0	26%	165,304	18%	28,279	0%	0	0%	0	0%	0	44%	39,117	0%	0	0%	0	14%	8,473
	Direct Consumption	28 Gas Consumed in Process	0%	0	33%	214,596	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	7%	4,500
	Total		**100%**	**78,657**	**100%**	**642,850**	**100%**	**157,395**	**100%**	**60,334**	**100%**	**206,793**	**100%**	**17,270**	**100%**	**88,976**	**100%**	**5,304,832**	**100%**	**1,339,668**	**100%**	**62,294**

Economic Case 2030 Forecast Sales by Service Area and Sub Sector

	SOUTHERN INTERIOR		Agriculture		Chemical		Fabricated Metal		Food & Beverage		Mining		Miscellaneous Manufacturing		Non-Metal Manufacturing		Pulp and Paper		Wood Products		Other	
	END USE	TECHNOLOGY	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)
COMFORT HEATING	Boilers	1 Standard Efficiency Boiler	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		2 Near Condensing Boilers	0%	0	0%	0	0%	0	3%	9,558	3%	50,297	8%	1,406	0%	0	0%	4,171	0%	0	0%	0
		3 Condensing Boiler	0%	0	0%	0	0%	0	2%	5,931	2%	40,486	4%	656	0%	0	0%	1,369	0%	0	0%	0
	Air Heating	4 Standard Efficiency Air Handling Units and Unit Heaters	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		5 High-efficiency Air Handling Units and Unit heaters (Condensing)	10%	9,925	14%	6,035	21%	11,700	8%	28,076	0%	5,951	27%	4,716	20%	19,584	4%	42,100	2%	13,248	31%	8,438
		6 Radiant Tube Heating	8%	7,822	17%	7,244	39%	22,503	9%	31,963	1%	13,125	32%	5,510	24%	23,602	2%	27,621	3%	15,966	38%	10,187
PROCESS HEATING	Boilers	1 Standard Efficiency Boiler	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		2 Near Condensing Boiler	0%	0	27%	11,270	0%	0	28%	96,374	20%	393,228	4%	680	6%	5,421	30%	356,385	7%	40,876	9%	2,468
		3 Condensing Boiler	81%	82,698	12%	5,114	0%	0	19%	66,088	14%	265,825	1%	227	2%	1,533	5%	63,847	3%	18,122	4%	1,190
	Water Heaters	4 Tank-type Water Heating	1%	1,209	0%	0	0%	0	2%	8,083	0%	0	2%	369	0%	0	0%	0	0%	0	2%	600
		5 Instantaneous Water Heater	0%	434	0%	0	0%	0	2%	7,292	0%	0	4%	634	0%	0	0%	0	0%	0	2%	623
		6 Direct-fired Water Heating	0%	0	0%	0	0%	0	12%	42,147	0%	0	0%	0	0%	0	0%	0	5%	27,813	0%	0
	Ovens	7 Standard Efficiency Oven	0%	0	0%	0	0%	0	0%	794	0%	0	0%	30	0%	466	0%	0	0%	0	0%	0
		8 Efficient Oven	0%	0	0%	0	0%	0	13%	45,267	0%	0	6%	1,061	8%	8,010	0%	0	0%	0	0%	0
	Heat Treating	9 Standard Efficiency Heat Treating Furnace	0%	0	0%	0	0%	244	0%	0	0%	0	0%	54	0%	0	0%	0	0%	0	0%	0
		10 Heat Treating Furnace with Sequential Firing, High-velocity Burners	0%	0	0%	0	33%	18,587	0%	0	0%	0	6%	983	0%	0	0%	0	0%	0	0%	0
	Lumber Kiln	11 Standard Efficiency Kiln	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	2%	10,559	0%	0
		12 High-efficiency Kiln	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	66%	389,283	0%	0
	Veneer Dryers	13 Standard Efficiency Veneer Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	585	0%	0
		14 Advanced Veneer Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	13%	74,961	0%	0
	Paper	15 Direct-fired Paper Drying	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	19%	221,096	0%	0	0%	0
	Pulp Lime Kilns	16 Standard Efficiency Pulp Lime Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	25%	291,099	0%	0	0%	0
		17 High-efficiency Pulp Lime Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	15%	175,824	0%	0	0%	0
	Cement Kilns	18 Standard Efficiency Cement Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	18%	17,561	0%	0	0%	0	0%	0
		19 High-efficiency Cement Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	16%	15,692	0%	0	0%	0	0%	0
	Ore Drying	20 Standard Efficiency Ore Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		21 High-efficiency Ore Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Coal Drying	22 Standard Efficiency Coal Dryer	0%	0	0%	0	0%	0	0%	0	50%	982,457	0%	0	0%	0	0%	0	0%	0	0%	0
		23 High-efficiency Coal Dryer (with centrifuge)	0%	0	0%	0	0%	0	0%	0	11%	216,777	0%	0	0%	0	0%	0	0%	0	0%	0
	Miscellaneous	24 Miscellaneous Standard Equipment	0%	0	0%	0	0%	0	0%	0	0%	0	2%	420	0%	0	0%	0	0%	0	0%	0
		25 Miscellaneous Efficient Equipment	0%	0	0%	0	0%	0	0%	0	0%	0	4%	722	0%	0	0%	0	0%	0	0%	0
	Laundry	26 Direct-fired Gas Laundry Dryers	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	3%	744
	Direct-fired	27 Direct-fired Heating	0%	0	29%	12,156	7%	3,947	0%	0	0%	0	0%	0	5%	5,126	0%	0	0%	0	3%	744
	Direct Consumption	28 Gas Consumed in Process	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	7%	1,859
	Total		**100%**	**102,088**	**100%**	**41,820**	**100%**	**56,981**	**100%**	**341,572**	**100%**	**1,968,146**	**100%**	**17,469**	**100%**	**96,996**	**100%**	**1,183,512**	**100%**	**591,414**	**100%**	**26,853**

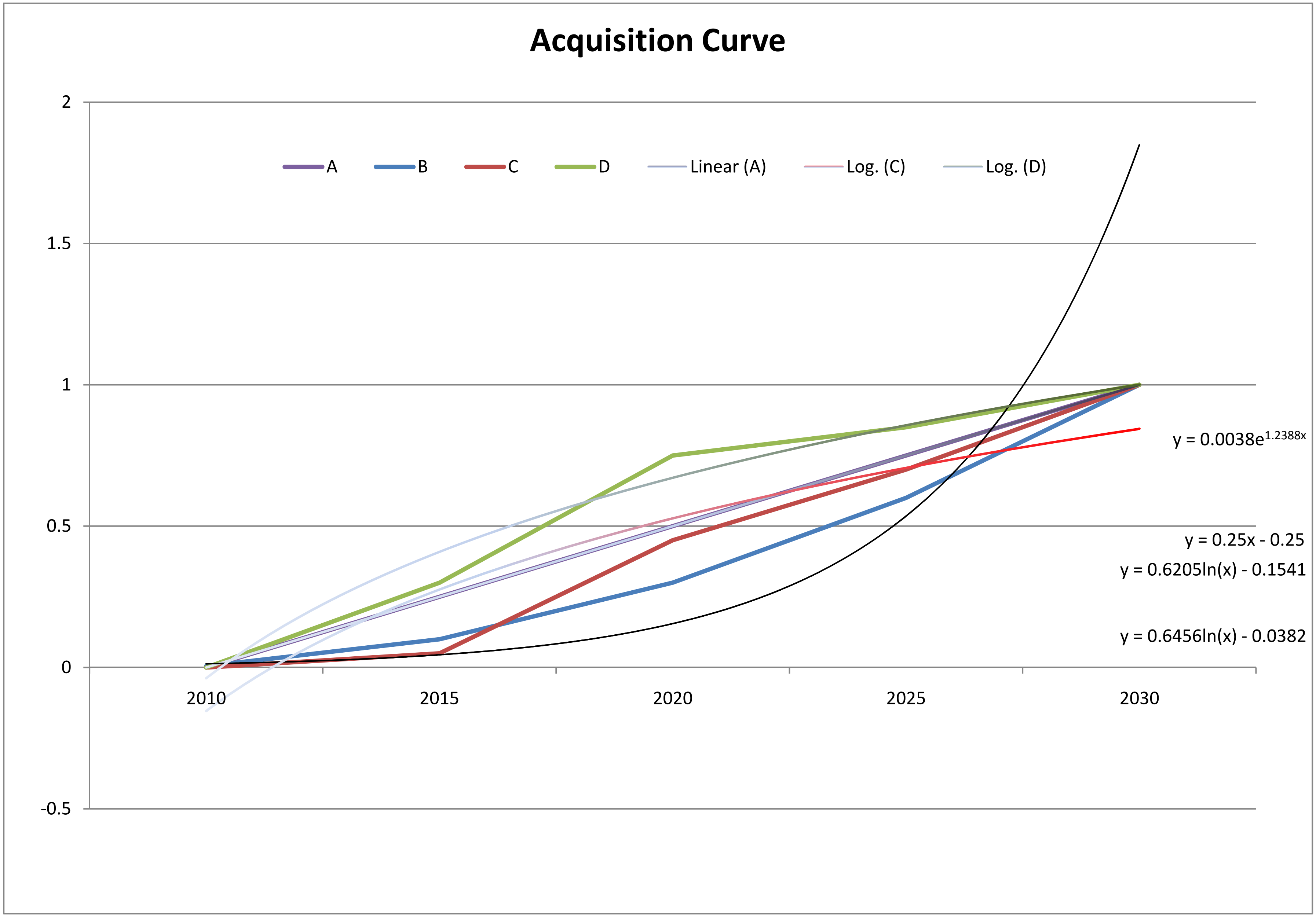
Economic Case 2030 Forecast Sales by Service Area and Sub Sector

	VANCOUVER ISLAND		Agriculture		Chemical		Fabricated Metal		Food & Beverage		Mining		Miscellaneous Manufacturing		Non-Metal Manufacturing		Pulp and Paper		Wood Products		Other	
	END USE	TECHNOLOGY	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)
COMFORT HEATING	Boilers	1 Standard Efficiency Boiler	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		2 Near Condensing Boilers	0%	0	0%	0	0%	0	1%	968	0%	0	1%	95	0%	0	2%	149	0%	0	0%	0
		3 Condensing Boiler	0%	0	0%	0	0%	0	1%	601	0%	0	0%	44	0%	0	1%	44	0%	0	0%	0
	Air Heating	4 Standard Efficiency Air Handling Units and Unit Heaters	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		5 High-efficiency Air Handling Units and Unit heaters (Condensing)	2%	532	9%	12,524	16%	1,013	2%	2,125	0%	0	2%	320	45%	33,684	2%	132	0%	0	2%	1,930
		6 Radiant Tube Heating	2%	418	11%	14,952	31%	1,947	2%	2,359	0%	0	3%	373	55%	40,515	2%	153	0%	0	2%	2,321
PROCESS HEATING	Boilers	1 Standard Efficiency Boiler	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		2 Near Condensing Boiler	0%	0	10%	13,548	0%	0	38%	45,530	0%	0	12%	1,813	0%	0	32%	2,212	7%	7,955	19%	21,491
		3 Condensing Boiler	94%	23,458	4%	5,292	0%	0	31%	36,626	0%	0	4%	605	0%	0	11%	722	3%	3,527	14%	16,093
	Water Heaters	4 Tank-type Water Heating	1%	343	0%	0	0%	0	4%	4,576	0%	0	7%	983	0%	0	0%	0	0%	0	5%	6,087
		5 Instantaneous Water Heater	0%	123	0%	0	0%	0	3%	4,129	0%	0	12%	1,688	0%	0	0%	0	0%	0	7%	7,352
		6 Direct-fired Water Heating	0%	0	0%	0	0%	0	18%	21,767	0%	0	0%	0	0%	0	0%	0	5%	5,413	0%	0
	Ovens	7 Standard Efficiency Oven	0%	0	0%	0	0%	0	0%	0	0%	0	1%	81	0%	0	0%	0	0%	0	0%	0
		8 Efficient Oven	0%	0	0%	0	0%	0	0%	0	0%	0	19%	2,827	0%	0	0%	0	0%	0	0%	0
	Heat Treating	9 Standard Efficiency Heat Treating Furnace	0%	0	0%	0	1%	36	0%	0	0%	0	1%	143	0%	0	0%	0	0%	0	0%	0
		10 Heat Treating Furnace with Sequential Firing, High-velocity Burners	0%	0	0%	0	43%	2,735	0%	0	0%	0	18%	2,620	0%	0	0%	0	0%	0	0%	0
	Lumber Kiln	11 Standard Efficiency Kiln	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	2%	2,055	0%	0
		12 High-efficiency Kiln	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	69%	75,763	0%	0
	Veneer Dryers	13 Standard Efficiency Veneer Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	114	0%	0
		14 Advanced Veneer Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	13%	14,589	0%	0
	Paper	15 Direct-fired Paper Drying	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	50%	3,418	0%	0	0%	0
	Pulp Lime Kilns	16 Standard Efficiency Pulp Lime Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		17 High-efficiency Pulp Lime Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Cement Kilns	18 Standard Efficiency Cement Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		19 High-efficiency Cement Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Ore Drying	20 Standard Efficiency Ore Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		21 High-efficiency Ore Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Coal Drying	22 Standard Efficiency Coal Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		23 High-efficiency Coal Dryer (with centrifuge)	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
	Miscellaneous	24 Miscellaneous Standard Equipment	0%	0	0%	0	0%	0	0%	0	0%	0	8%	1,121	0%	0	0%	0	0%	0	0%	0
		25 Miscellaneous Efficient Equipment	0%	0	0%	0	0%	0	0%	0	0%	0	13%	1,924	0%	0	0%	0	0%	0	0%	0
	Laundry	26 Direct-fired Gas Laundry Dryers	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	21%	23,563
	Direct-fired	27 Direct-fired Heating	0%	0	67%	94,540	9%	581	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	8%	9,425
	Direct Consumption	28 Gas Consumed in Process	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	21%	23,563
	Total		**100%**	**24,874**	**100%**	**140,856**	**100%**	**6,311**	**100%**	**118,681**	**0%**	**0**	**100%**	**14,637**	**100%**	**74,199**	**100%**	**6,831**	**100%**	**109,416**	**100%**	**111,825**

Economic Case 2030 Forecast Sales by Service Area and Sub Sector

	TOTAL SERVICE AREAS		Agriculture		Chemical		Fabricated Metal		Food & Beverage		Mining		Miscellaneous Manufacturing		Non-Metal Manufacturing		Pulp and Paper		Wood Products		Other	
	END USE	TECHNOLOGY	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)	Market Share	Total Sales (GJ)
COMFORT HEATING	Boilers	1 Standard Efficiency Boiler	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		2 Near Condensing Boilers	0%	0	0%	0	0%	0	2%	60,224	3%	61,181	2%	4,682	0%	0	0%	25,623	0%	0	0%	0
		3 Condensing Boiler	0%	0	0%	0	0%	0	1%	35,003	2%	46,436	1%	2,185	0%	0	0%	8,392	0%	0	0%	0
	Air Heating	4 Standard Efficiency Air Handling Units and Unit Heaters	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		5 High-efficiency Air Handling Units and Unit heaters (Condensing)	12%	335,512	2%	59,097	10%	101,872	3%	105,170	1%	17,830	6%	15,755	10%	126,215	3%	254,542	2%	49,469	20%	105,743
		6 Radiant Tube Heating	9%	263,788	4%	125,036	20%	199,073	4%	115,811	1%	31,508	78%	222,293	11%	151,875	2%	167,102	2%	59,603	24%	127,299
PROCESS HEATING	Boilers	1 Standard Efficiency Boiler	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0
		2 Near Condensing Boiler	0%	0	25%	763,007	5%	51,772	30%	926,197	19%	428,115	2%	5,168	2%	22,998	31%	2,301,531	7%	188,470	16%	85,166
		3 Condensing Boiler	77%	2,185,044	7%	221,115	1%	12,112	25%	786,130	13%	289,409	1%	1,726	0%	6,504	6%	416,205	3%	83,556	9%	50,091
	Water Heaters	4 Tank-type Water Heating	1%	30,921	0%	0	0%	0	2%	69,926	0%	0	1%	2,803	0%	0	0%	0	0%	0	3%	18,007
		5 Instantaneous Water Heater	0%	11,091	0%	0	0%	0	2%	63,085	0%	0	2%	4,815	0%	0	0%	0	0%	0	3%	18,397
		6 Direct-fired Water Heating	0%	0	0%	0	0%	0	18%	554,660	0%	0	0%	0	0%	0	0%	0	5%	128,239	0%	0
	Ovens	7 Standard Efficiency Oven	0%	0	0%	0	0%	0	0%	6,622	0%	0	0%	231	0%	4,303	0%	0	0%	0	0%	0
		8 Efficient Oven	0%	0	0%	0	0%	0	13%	412,527	0%	0	3%	8,063	5%	71,347	0%	0	0%	0	0%	0
	Heat Treating	9 Standard Efficiency Heat Treating Furnace	0%	0	0%	0	1%	7,330	0%	0	0%	0	0%	407	0%	0	0%	0	0%	0	0%	0
		10 Heat Treating Furnace with Sequential Firing, High-velocity Burners	0%	0	0%	0	50%	501,617	0%	0	0%	0	3%	7,472	0%	0	0%	0	0%	0	0%	0
	Lumber Kiln	11 Standard Efficiency Kiln	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	2%	48,686	0%	0
		12 High-efficiency Kiln	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	66%	1,794,877	0%	0
	Veneer Dryers	13 Standard Efficiency Veneer Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	2,697	0%	0
		14 Advanced Veneer Dryer	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	13%	345,627	0%	0
	Paper	15 Direct-fired Paper Drying	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	19%	1,425,722	0%	0	0%	0
	Pulp Lime Kilns	16 Standard Efficiency Pulp Lime Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	24%	1,794,837	0%	0	0%	0
		17 High-efficiency Pulp Lime Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	14%	1,079,436	0%	0	0%	0
	Cement Kilns	18 Standard Efficiency Cement Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	26%	350,576	0%	0	0%	0	0%	0
		19 High-efficiency Cement Kilns	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	10%	126,377	0%	0	0%	0	0%	0
	Ore Drying	20 Standard Efficiency Ore Dryer	0%	0	0%	0	0%	0	0%	0	4%	93,561	0%	0	0%	0	0%	0	0%	0	0%	0
		21 High-efficiency Ore Dryer	0%	0	0%	0	0%	0	0%	0	1%	19,233	0%	0	0%	0	0%	0	0%	0	0%	0
	Coal Drying	22 Standard Efficiency Coal Dryer	0%	0	0%	0	0%	0	0%	0	45%	982,457	0%	0	0%	0	0%	0	0%	0	0%	0
		23 High-efficiency Coal Dryer (with centrifuge)	0%	0	0%	0	0%	0	0%	0	10%	216,777	0%	0	0%	0	0%	0	0%	0	0%	0
	Miscellaneous	24 Miscellaneous Standard Equipment	0%	0	0%	0	0%	0	0%	0	0%	0	1%	3,195	0%	0	0%	0	0%	0	0%	0
		25 Miscellaneous Efficient Equipment	0%	0	0%	0	0%	0	0%	0	0%	0	2%	5,487	0%	0	0%	0	0%	0	0%	0
	Laundry	26 Direct-fired Gas Laundry Dryers	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	9%	48,021
	Direct-fired	27 Direct-fired Heating	0%	0	30%	908,635	13%	127,231	0%	0	1%	11,228	0%	0	35%	468,141	0%	0	0%	0	5%	28,443
	Direct Consumption	28 Gas Consumed in Process	0%	0	31%	946,323	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	10%	54,423
	Total		**100%**	**2,826,356**	**100%**	**3,023,213**	**100%**	**1,001,009**	**100%**	**3,135,355**	**100%**	**2,197,734**	**100%**	**284,283**	**100%**	**1,328,337**	**100%**	**7,473,389**	**100%**	**2,701,225**	**100%**	**535,588**

Appendix E Background-Chapter 7: Achievable Potential Forecasts


Acquisition Curve
2
1.5
1
0.5
0
-0.5
A
B
C
D
Linear (A)
Log. (C)
Log. (D)
y = 0.0038e^1.2388x
y = 0.25x - 0.25
y = 0.6205ln(x) - 0.1541
y = 0.6456ln(x) - 0.0382
2010
2015
2020
2025
2030

Acquisition Curve Selection

MEASURE #	MEASURE NAME		Percent	CURVE
1a	Condensing Boilers	Most Likely	75%	A
		AGGRESSIVE	90%	D
1b	Near Condensing Boilers	Most Likely	75%	A
		AGGRESSIVE	100%	D
1c	Direct-fired Paper Drying	Most Likely	30%	B
		AGGRESSIVE	50%	B
1d	Direct-fired Water Heating	Most Likely	40%	B
		AGGRESSIVE	70%	B
2	High-efficiency Pulp Lime Kilns	Most Likely	40%	B
		AGGRESSIVE	100%	B
3	Standard Efficiency Coal Dryer	Most Likely	100%	D
		AGGRESSIVE	100%	D
4	Standard Efficiency Ore Dryer	Most Likely	50%	D
		AGGRESSIVE	100%	D
5a	High-efficiency Kiln	Most Likely	60%	A
		AGGRESSIVE	80%	A
5b	Advanced Veneer Dryer	Most Likely	50%	A
		AGGRESSIVE	80%	A
6	Direct-fired Heating	Most Likely	50%	D
		AGGRESSIVE	100%	D
7	High-efficiency Air Handling Units and Unit heaters (Condensing)	Most Likely	80%	A
		AGGRESSIVE	100%	A
8	Standard Efficiency Cement Kilns	Most Likely	50%	A
		AGGRESSIVE	100%	C
9	Heat Treating Furnace with Sequential Firing, High-velocity Burners	Most Likely	35%	C
		AGGRESSIVE	70%	C
10	Efficient Oven	Most Likely	35%	C
		AGGRESSIVE	70%	C

Energy-efficiency Measure	**M1a : Standard to Condensing Boilers**															
Participant Definition	**Condensing Process Hot Water or High-efficiency Process Steam Boilers**															
Service Area	**Lower Mainland**				**N. Interior**				**S. Interior**				**Vancouver Island**			
Technology/Economic Potential Share	Near Condensing Boilers				Near Condensing Boilers				Near Condensing Boilers				Near Condensing Boilers			
Economic Potential Share	67%				14%				16%				3%			
MILESTONES	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**
Economic Potential Savings (GJ/yr.)	500,348	462,644	435,184	424,731	107,517	102,001	96,712	91,720	119,460	121,547	124,885	129,965	22,592	21,305	22,231	21,346
Participation Constraints	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%
Economic Potential Available for DSM	450,313	416,380	391,666	382,258	96,765	91,801	87,041	82,548	107,514	109,392	112,397	116,969	20,333	19,174	20,008	19,211
Approximate Economic Potential Annual Savings per Project (GJ)	144,862				144,862				144,862				72,431			
Approximate Benefit-cost Ratio (Marginal Supply Cost of Gas ~$11/GJ)	5.1				5.1				5.1				5.3			
Approximate Customer Payback (Customer Cost of Gas ~$6/GJ)	5.4				5.4				5.4				3.3			
Participation Rate (% of Available Economic Potential)																
Most Likely	75%	75%	75%	75%	75%	75%	75%	75%	75%	75%	75%	75%	75%	75%	75%	75%
Agressive	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%
Action Savings (GJ/yr.)																
Most Likely	337,735	312,285	293,750	286,694	72,574	68,851	65,280	61,911	80,635	82,044	84,297	87,727	15,249	14,381	15,006	14,409
Aggressive	405,282	374,742	352,499	344,032	87,089	82,621	78,337	74,293	96,762	98,453	101,157	105,272	18,299	17,257	18,007	17,290
Participation Rate (% of Total Economic Potential)																
Most Likely	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%
Aggressive	81%	81%	81%	81%	81%	81%	81%	81%	81%	81%	81%	81%	81%	81%	81%	81%
MILESTONE	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**
Total Savings (GJ/yr.)																
Economic Potential	500,348	462,644	435,184	424,731	107,517	102,001	96,712	91,720	119,460	121,547	124,885	129,965	22,592	21,305	22,231	21,346
Most Likely	337,735	312,285	293,750	286,694	72,574	68,851	65,280	61,911	80,635	82,044	84,297	87,727	15,249	14,381	15,006	14,409
Aggressive	405,282	374,742	352,499	344,032	87,089	82,621	78,337	74,293	96,762	98,453	101,157	105,272	18,299	17,257	18,007	17,290
POTENTIAL SAVINGS ACQUISITION																
Accumulated Available																
Most Likely	337,735	312,285	293,750	286,694	72,574	68,851	65,280	61,911	80,635	82,044	84,297	87,727	15,249	14,381	15,006	14,409
Aggressive	405,282	374,742	352,499	344,032	87,089	82,621	78,337	74,293	96,762	98,453	101,157	105,272	18,299	17,257	18,007	17,290
Residual																
Most Likely																
Aggressive																
Annual Acquired Savings																
Most Likely A	84,434	156,142	220,312	286,694	18,144	34,425	48,960	61,911	20,159	41,022	63,223	87,727	3,812	7,190	11,254	14,409
Aggressive D	121,585	281,056	299,624	344,032	26,127	61,966	66,586	74,293	29,029	73,840	85,983	105,272	5,490	12,943	15,306	17,290

MILESTONE	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**
Total Savings (GJ/yr.)				
Economic Potential	749,917	707,497	679,012	667,762
Most Likely	506,194	477,560	458,333	450,740
Aggressive	607,432	573,072	550,000	540,887
POTENTIAL SAVINGS ACQUISITION				
Accumulated Available				
Most Likely	506,194	477,560	458,333	450,740
Aggressive	607,432	573,072	550,000	540,887
Residual				
Most Likely	0	0	0	0
Aggressive	0	0	0	0
Annual Acquired Savings				
Most Likely A	126,548	238,780	343,750	450,740
Aggressive D	182,230	429,804	467,500	540,887

Energy-efficiency Measure	**M1b : Standard to Near condensing Boilers**															
Participant Definition	**Near Condensing Process Hot Water or High-efficiency Process Steam Boilers**															
Service Area	**Lower Mainland**				**N. Interior**				**S. Interior**				**Vancouver Island**			
Technology/Economic Potential Share	Standard Efficiency Boiler				Standard Efficiency Boiler				Standard Efficiency Boiler				Standard Efficiency Boiler			
Economic Potential Share	42%				35%				21%				2%			
MILESTONES	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**
Economic Potential Savings (GJ/yr.)	299,163	328,343	360,785	395,142	246,920	267,311	290,958	318,800	147,539	158,478	170,851	185,058	16,500	17,281	18,140	19,099
Participation Constraints	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%
Economic Potential Available for DSM	269,247	295,509	324,706	355,628	222,228	240,580	261,862	286,920	132,785	142,630	153,766	166,552	14,850	15,553	16,326	17,189
Approximate Economic Potential Annual Savings per Project (GJ)	1,462				1,462				1,462				1,462			
Approximate Benefit-cost Ratio (Marginal Supply Cost of Gas ~$11/GJ)	4.5				4.5				4.5				4.7			
Approximate Customer Payback (Customer Cost of Gas ~$6/GJ)	6.1				6.1				6.1				3.8			
Participation Rate (% of Available Economic Potential)																
Most Likely	75%	75%	75%	75%	75%	75%	75%	75%	75%	75%	75%	75%	75%	75%	75%	75%
Agressive	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Action Savings (GJ/yr.)																
Most Likely	201,935	221,632	243,530	266,721	166,671	180,435	196,397	215,190	99,589	106,973	115,325	124,914	11,137	11,665	12,245	12,892
Aggressive	269,247	295,509	324,706	355,628	222,228	240,580	261,862	286,920	132,785	142,630	153,766	166,552	14,850	15,553	16,326	17,189
Participation Rate (% of Total Economic Potential)																
Most Likely	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%
Aggressive	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%
MILESTONE	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**
Total Savings (GJ/yr.)																
Economic Potential	299,163	328,343	360,785	395,142	246,920	267,311	290,958	318,800	147,539	158,478	170,851	185,058	16,500	17,281	18,140	19,099
Most Likely	201,935	221,632	243,530	266,721	166,671	180,435	196,397	215,190	99,589	106,973	115,325	124,914	11,137	11,665	12,245	12,892
Aggressive	269,247	295,509	324,706	355,628	222,228	240,580	261,862	286,920	132,785	142,630	153,766	166,552	14,850	15,553	16,326	17,189
POTENTIAL SAVINGS ACQUISITION																
Accumulated Available																
Most Likely	201,935	221,632	243,530	266,721	166,671	180,435	196,397	215,190	99,589	106,973	115,325	124,914	11,137	11,665	12,245	12,892
Aggressive	269,247	295,509	324,706	355,628	222,228	240,580	261,862	286,920	132,785	142,630	153,766	166,552	14,850	15,553	16,326	17,189
Residual																
Most Likely																
Aggressive																
Annual Acquired Savings																
Most Likely A	50,484	110,816	182,647	266,721	41,668	90,217	147,297	215,190	24,897	53,486	86,493	124,914	2,784	5,832	9,184	12,892
Aggressive D	80,774	221,632	276,000	355,628	66,668	180,435	222,583	286,920	39,836	106,973	130,701	166,552	4,455	11,665	13,877	17,189

MILESTONE	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**
Total Savings (GJ/yr.)				
Economic Potential	710,122	771,413	840,734	918,100
Most Likely	479,332	520,704	567,496	619,717
Aggressive	639,110	694,271	756,661	826,290
POTENTIAL SAVINGS ACQUISITION				
Accumulated Available				
Most Likely	479,332	520,704	567,496	619,717
Aggressive	639,110	694,271	756,661	826,290
Residual				
Most Likely	0	0	0	0
Aggressive	0	0	0	0
Annual Acquired Savings				
Most Likely A	119,833	260,352	425,622	619,717
Aggressive D	191,733	520,704	643,162	826,290

Energy-efficiency Measure	**M1c : Direct-fired Paper Drying**															
Participant Definition	**Paper Mills**															
Service Area	**Lower Mainland**				**N. Interior**				**S. Interior**				**Vancouver Island**			
Technology/Economic Potential Share	Convert To Direct Fired Paper Drying - 100%				Convert To Direct Fired Paper Drying - 100%				Convert To Direct Fired Paper Drying - 100%				Convert To Direct Fired Paper Drying - 100%			
Economic Potential Share	22%				58%				19%				0%			
MILESTONES	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**
Economic Potential Savings (GJ/yr.)	46,339	41,373	37,511	33,775	120,746	106,747	92,978	79,421	39,310	35,795	32,355	28,982	468	448	426	402
Participation Constraints	20%	15%	15%	15%	10%	15%	15%	15%	20%	15%	15%	15%	50%	25%	25%	25%
Economic Potential Available for DSM	37,071	35,167	31,885	28,708	108,671	90,735	79,031	67,508	31,448	30,426	27,502	24,635	234	336	319	301
Approximate Economic Potential Annual Savings per Project (GJ)	73,000				73,000				73,000				73,000			
Approximate Benefit-cost Ratio (Marginal Supply Cost of Gas ~$11/GJ)	9.2				9.2				9.2				5.9			
Approximate Customer Payback (Customer Cost of Gas ~$6/GJ)	3.0				3.0				3.0				3.0			
Participation Rate (% of Available Economic Potential)																
Most Likely	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%
Agressive	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%
Action Savings (GJ/yr.)																
Most Likely	11,121	10,550	9,565	8,613	32,601	27,220	23,709	20,252	9,434	9,128	8,250	7,390	70	101	96	90
Aggressive	18,536	17,584	15,942	14,354	54,336	45,367	39,516	33,754	15,724	15,213	13,751	12,317	117	168	160	151
Participation Rate (% of Total Economic Potential)																
Most Likely	24%	26%	26%	26%	27%	26%	26%	26%	24%	26%	26%	26%	15%	23%	23%	23%
Aggressive	40%	43%	43%	43%	45%	43%	43%	43%	40%	43%	43%	43%	25%	38%	38%	38%
MILESTONE	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**
Total Savings (GJ/yr.)																
Economic Potential	46,339	41,373	37,511	33,775	120,746	106,747	92,978	79,421	39,310	35,795	32,355	28,982	468	448	426	402
Most Likely	11,121	10,550	9,565	8,613	32,601	27,220	23,709	20,252	9,434	9,128	8,250	7,390	70	101	96	90
Aggressive	18,536	17,584	15,942	14,354	54,336	45,367	39,516	33,754	15,724	15,213	13,751	12,317	117	168	160	151
POTENTIAL SAVINGS ACQUISITION																
Accumulated Available																
Most Likely	11,121	10,550	9,565	8,613	32,601	27,220	23,709	20,252	9,434	9,128	8,250	7,390	70	101	96	90
Aggressive	18,536	17,584	15,942	14,354	54,336	45,367	39,516	33,754	15,724	15,213	13,751	12,317	117	168	160	151
Residual																
Most Likely																
Aggressive																
Annual Acquired Savings																
Most Likely B	1,112	3,165	5,739	8,613	3,260	8,166	14,226	20,252	943	2,738	4,950	7,390	7	30	57	90
Aggressive B	1,854	5,275	9,565	14,354	5,434	13,610	23,709	33,754	1,572	4,564	8,250	12,317	12	50	96	151

MILESTONE	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**
Total Savings (GJ/yr.)				
Economic Potential	206,863	184,364	163,270	142,579
Most Likely	53,227	46,999	41,621	36,346
Aggressive	88,712	78,332	69,368	60,576
POTENTIAL SAVINGS ACQUISITION				
Accumulated Available				
Most Likely	53,227	46,999	41,621	36,346
Aggressive	88,712	78,332	69,368	60,576
Residual				
Most Likely	0	0	0	0
Aggressive	0	0	0	0
Annual Acquired Savings				
Most Likely B	5,323	14,100	24,973	36,346
Aggressive B	8,871	23,500	41,621	60,576

Energy-efficiency Measure	**M1d : Direct-fired Water Heating**															
Participant Definition	**Food Processing**															
Service Area	**Lower Mainland**				**N. Interior**				**S. Interior**				**Vancouver Island**			
Technology/Economic Potential Share	Change to Direct Fired Water Heating (3200 100%				Change to Direct Fired Water Heating (3200 100%				Change to Direct Fired Water Heating (3200 100%				Change to Direct Fired Water Heating (3200 100%			
Economic Potential Share	84%				1%				9%				5%			
MILESTONES	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**
Economic Potential Savings (GJ/yr.)	126,734	130,260	133,596	136,755	1,795	1,445	1,134	852	14,173	14,638	15,078	15,491	8,144	8,337	8,518	8,685
Participation Constraints	25%	25%	25%	25%	10%	10%	10%	10%	20%	20%	20%	20%	25%	25%	25%	25%
Economic Potential Available for DSM	95,050	97,695	100,197	102,566	1,615	1,301	1,021	767	11,338	11,711	12,062	12,393	6,108	6,253	6,388	3
Approximate Economic Potential Annual Savings per Project (GJ)	2,985				2,985				2,985				2,985			
Approximate Benefit-cost Ratio (Marginal Supply Cost of Gas ~$11/GJ)	1.9				1.9				1.9				2.0			
Approximate Customer Payback (Customer Cost of Gas ~$6/GJ)	10.5				10.5				10.5				6.5			
Participation Rate (% of Available Economic Potential)																
Most Likely	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%
Agressive	70%	70%	70%	70%	70%	70%	70%	70%	70%	70%	70%	70%	70%	70%	70%	70%
Action Savings (GJ/yr.)																
Most Likely	38,020	39,078	40,079	41,027	646	520	408	307	4,535	4,684	4,825	4,957	2,443	2,501	2,555	1
Aggressive	66,535	68,387	70,138	71,796	1,131	911	715	537	7,937	8,198	8,444	8,675	4,275	4,377	4,472	2
Participation Rate (% of Total Economic Potential)																
Most Likely	30%	30%	30%	30%	36%	36%	36%	36%	32%	32%	32%	32%	30%	30%	30%	0%
Aggressive	53%	53%	53%	53%	63%	63%	63%	63%	56%	56%	56%	56%	53%	53%	53%	0%
MILESTONE	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**
Total Savings (GJ/yr.)																
Economic Potential	126,734	130,260	133,596	136,755	1,795	1,445	1,134	852	14,173	14,638	15,078	15,491	8,144	8,337	8,518	8,685
Most Likely	38,020	39,078	40,079	41,027	646	520	408	307	4,535	4,684	4,825	4,957	2,443	2,501	2,555	1
Aggressive	66,535	68,387	70,138	71,796	1,131	911	715	537	7,937	8,198	8,444	8,675	4,275	4,377	4,472	2
POTENTIAL SAVINGS ACQUISITION																
Accumulated Available																
Most Likely	38,020	39,078	40,079	41,027	646	520	408	307	4,535	4,684	4,825	4,957	2,443	2,501	2,555	1
Aggressive	66,535	68,387	70,138	71,796	1,131	911	715	537	7,937	8,198	8,444	8,675	4,275	4,377	4,472	2
Residual																
Most Likely																
Aggressive																
Annual Acquired Savings																
Most Likely B	3,802	11,723	24,047	41,027	65	156	245	307	454	1,405	2,895	4,957	244	750	1,533	1
Aggressive B	6,654	20,516	42,083	71,796	113	273	429	537	794	2,459	5,066	8,675	428	1,313	2,683	2

MILESTONE	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**
Total Savings (GJ/yr.)				
Economic Potential	150,845	154,681	158,326	161,784
Most Likely	45,645	46,784	47,867	46,292
Aggressive	79,878	81,872	83,768	81,010
POTENTIAL SAVINGS ACQUISITION				
Accumulated Available				
Most Likely	45,645	46,784	47,867	46,292
Aggressive	79,878	81,872	83,768	81,010
Residual				
Most Likely	0	0	0	0
Aggressive	0	0	0	0
Annual Acquired Savings				
Most Likely B	4,564	14,035	28,720	46,292
Aggressive B	7,988	24,561	50,261	81,010

Energy-efficiency Measure	**M2 : Pulp Lime Kilns**															
Participant Definition	**Kraft Pulp Mills**															
Service Area	**Lower Mainland**				**N. Interior**				**S. Interior**				**Vancouver Island**			
Technology/Economic Potential Share	Add Insulation to Pulp Lime Kilns 55%				Add Insulation to Pulp Lime Kilns 55%				Add Insulation to Pulp Lime Kilns 55%				Add Insulation to Pulp Lime Kilns 55%			
	Upgrade Kiln Burner and Optimize Control 45%				Upgrade Kiln Burner and Optimize Control 45%				Upgrade Kiln Burner and Optimize Control 45%				Upgrade Kiln Burner and Optimize Control 45%			
Economic Potential Share	11%				73%				16%				0%			
MILESTONES	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**
Economic Potential Savings (GJ/yr.)	9,607	1,291	1,204	1,139	65,845	64,078	62,310	60,542	14,681	14,287	13,893	13,499	0	0	0	0
Participation Constraints	20%	20%	20%	20%	20%	15%	15%	15%	20%	15%	15%	15%	50%	25%	25%	25%
Economic Potential Available for DSM	7,685	1,033	963	911	52,676	54,466	52,963	51,461	11,745	12,144	11,809	11,474	0	0	0	0
Approximate Economic Potential Annual Savings per Project (GJ)	70,832				70,832				70,832				70,832			
Approximate Benefit-cost Ratio (Marginal Supply Cost of Gas ~$11/GJ)	4.5				4.5				4.5				4.5			
Approximate Customer Payback (Customer Cost of Gas ~$6/GJ)	6.1				6.1				6.1				6.1			
Participation Rate (% of Available Economic Potential)																
Most Likely	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%
Agressive	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Action Savings (GJ/yr.)																
Most Likely	3,074	413	385	364	21,070	21,786	21,185	20,584	4,698	4,858	4,724	4,590	0	0	0	0
Aggressive	7,685	1,033	963	911	52,676	54,466	52,963	51,461	11,745	12,144	11,809	11,474	0	0	0	0
Participation Rate (% of Total Economic Potential)																
Most Likely	32%	32%	32%	32%	32%	34%	34%	34%	32%	34%	34%	34%	-	-	-	-
Aggressive	80%	80%	80%	80%	80%	85%	85%	85%	80%	85%	85%	85%	-	-	-	-
MILESTONE	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**
Total Savings (GJ/yr.)																
Economic Potential	9,607	1,291	1,204	1,139	65,845	64,078	62,310	60,542	14,681	14,287	13,893	13,499	0	0	0	0
Most Likely	3,074	413	385	364	21,070	21,786	21,185	20,584	4,698	4,858	4,724	4,590	0	0	0	0
Aggressive	7,685	1,033	963	911	52,676	54,466	52,963	51,461	11,745	12,144	11,809	11,474	0	0	0	0
POTENTIAL SAVINGS ACQUISITION																
Accumulated Available																
Most Likely	3,074	413	385	364	21,070	21,786	21,185	20,584	4,698	4,858	4,724	4,590	0	0	0	0
Aggressive	7,685	1,033	963	911	52,676	54,466	52,963	51,461	11,745	12,144	11,809	11,474	0	0	0	0
Residual																
Most Likely																
Aggressive																
Annual Acquired Savings																
Most Likely B	307	124	231	364	2,107	6,536	12,711	20,584	470	1,457	2,834	4,590	0	0	0	0
Aggressive B	769	310	578	911	5,268	16,340	31,778	51,461	1,175	3,643	7,085	11,474	0	0	0	0

MILESTONE	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**
Total Savings (GJ/yr.)				
Economic Potential	90,134	79,656	77,407	75,180
Most Likely	28,843	27,057	26,294	25,538
Aggressive	72,107	67,643	65,736	63,846
POTENTIAL SAVINGS ACQUISITION				
Accumulated Available				
Most Likely	28,843	27,057	26,294	25,538
Aggressive	72,107	67,643	65,736	63,846
Residual				
Most Likely	0	0	0	0
Aggressive	0	0	0	0
Annual Acquired Savings				
Most Likely B	2,884	8,117	15,777	25,538
Aggressive B	7,211	20,293	39,441	63,846

Energy-efficiency Measure	**M3 : Coal Drying**															
Participant Definition	**Coal Mines utilizing coal washing equipment**															
Service Area	**Lower Mainland**				**N. Interior**				**S. Interior**				**Vancouver Island**			
Technology/Economic Potential Share	Conventional (Non-Vibrating) Fluid Bed Ther 100%				Conventional (Non-Vibrating) Fluid Bed Ther 100%				Conventional (Non-Vibrating) Fluid Bed Ther 100%				Conventional (Non-Vibrating) Fluid Bed Ther 100%			
Economic Potential Share	0%				0%				100%				0%			
MILESTONES	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**
Economic Potential Savings (GJ/yr.)	0	0	0	0	0	0	0	0	177,853	170,442	163,032	155,621	0	0	0	0
Participation Constraints	20%	20%	20%	20%	20%	20%	20%	20%	0%	0%	20%	20%	20%	20%	20%	20%
Economic Potential Available for DSM	0	0	0	0	0	0	0	0	177,853	170,442	130,425	124,497	0	0	0	0
Approximate Economic Potential Annual Savings per Project (GJ)	164,235				164,235				164,235				164,235			
Approximate Benefit-cost Ratio (Marginal Supply Cost of Gas ~$11/GJ)	15.5				15.5				15.5				15.5			
Approximate Customer Payback (Customer Cost of Gas ~$6/GJ)	1.6				1.6				1.6				1.6			
Participation Rate (% of Available Economic Potential)																
Most Likely	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Agressive	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Action Savings (GJ/yr.)																
Most Likely	0	0	0	0	0	0	0	0	177,853	170,442	130,425	124,497	0	0	0	0
Aggressive	0	0	0	0	0	0	0	0	177,853	170,442	130,425	124,497	0	0	0	0
Participation Rate (% of Total Economic Potential)																
Most Likely	0%	0%	0%	0%	0%	0%	0%	0%	100%	100%	80%	80%	0%	0%	0%	0%
Aggressive	0%	0%	0%	0%	0%	0%	0%	0%	100%	100%	80%	80%	0%	0%	0%	0%
MILESTONE	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**
Total Savings (GJ/yr.)																
Economic Potential	0	0	0	0	0	0	0	0	177,853	170,442	163,032	155,621	0	0	0	0
Most Likely	0	0	0	0	0	0	0	0	177,853	170,442	130,425	124,497	0	0	0	0
Aggressive	0	0	0	0	0	0	0	0	177,853	170,442	130,425	124,497	0	0	0	0
POTENTIAL SAVINGS ACQUISITION																
Accumulated Available																
Most Likely	0	0	0	0	0	0	0	0	177,853	170,442	130,425	124,497	0	0	0	0
Aggressive	0	0	0	0	0	0	0	0	177,853	170,442	130,425	124,497	0	0	0	0
Residual																
Most Likely																
Aggressive																
Annual Acquired Savings																
Most Likely D	0	0	0	0	0	0	0	0	53,356	127,832	110,862	124,497	0	0	0	0
Aggressive D	0	0	0	0	0	0	0	0	53,356	127,832	110,862	124,497	0	0	0	0

MILESTONE	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**
Total Savings (GJ/yr.)				
Economic Potential	177,853	170,442	163,032	155,621
Most Likely	177,853	170,442	130,425	124,497
Aggressive	177,853	170,442	130,425	124,497
POTENTIAL SAVINGS ACQUISITION				
Accumulated Available				
Most Likely	177,853	170,442	130,425	124,497
Aggressive	177,853	170,442	130,425	124,497
Residual				
Most Likely	0	0	0	0
Aggressive	0	0	0	0
Annual Acquired Savings				
Most Likely D	53,356	127,832	110,862	124,497
Aggressive D	53,356	127,832	110,862	124,497

Energy-efficiency Measure	M4 : Ore Drying															
Participant Definition	Copper mining utilizing concentrate dryer															
Service Area	Lower Mainland				N. Interior				S. Interior				Vancouver Island			
Technology/Economic Potential Share	Optimize concentrate dryer		100%		Optimize concentrate dryer		100%		Optimize concentrate dryer		100%		Optimize concentrate dryer		100%	
Economic Potential Share	0%				100%				0%				0%			
MILESTONES	Period One to 2015	Period Two to 2020	Period Three to 2025	Period Four to 2030	Period One to 2015	Period Two to 2020	Period Three to 2025	Period Four to 2030	Period One to 2015	Period Two to 2020	Period Three to 2025	Period Four to 2030	Period One to 2015	Period Two to 2020	Period Three to 2025	Period Four to 2030
Economic Potential Savings (GJ/yr.)	0	0	0	0	8,469	8,116	7,763	7,410	0	0	0	0	0	0	0	0
Participation Constraints	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
Economic Potential Available for DSM	0	0	0	0	6,775	6,493	6,210	5,928	0	0	0	0	0	0	0	0
Approximate Economic Potential Annual Savings per Project (GJ)	7,285				7,285				7,285				7,285			
Approximate Benefit-cost Ratio (Marginal Supply Cost of Gas ~$11/GJ)	8.7				8.7				8.7				8.7			
Approximate Customer Payback (Customer Cost of Gas ~$6/GJ)	2.9				2.9				2.9				2.9			
Participation Rate (% of Available Economic Potential)																
Most Likely	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%
Agressive	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Action Savings (GJ/yr.)																
Most Likely	0	0	0	0	3,387	3,246	3,105	2,964	0	0	0	0	0	0	0	0
Aggressive	0	0	0	0	6,775	6,493	6,210	5,928	0	0	0	0	0	0	0	0
Participation Rate (% of Total Economic Potential)																
Most Likely	0%	0%	0%	0%	40%	40%	40%	40%	0%	0%	0%	0%	0%	0%	0%	0%
Aggressive	0%	0%	0%	0%	80%	80%	80%	80%	0%	0%	0%	0%	0%	0%	0%	0%
MILESTONE	Period One to 2015	Period Two to 2020	Period Three to 2025	Period Four to 2030	Period One to 2015	Period Two to 2020	Period Three to 2025	Period Four to 2030	Period One to 2015	Period Two to 2020	Period Three to 2025	Period Four to 2030	Period One to 2015	Period Two to 2020	Period Three to 2025	Period Four to 2030
Total Savings (GJ/yr.)																
Economic Potential	0	0	0	0	8,469	8,116	7,763	7,410	0	0	0	0	0	0	0	0
Most Likely	0	0	0	0	3,387	3,246	3,105	2,964	0	0	0	0	0	0	0	0
Aggressive	0	0	0	0	6,775	6,493	6,210	5,928	0	0	0	0	0	0	0	0
POTENTIAL SAVINGS ACQUISITION																
Accumulated Available																
Most Likely	0	0	0	0	3,387	3,246	3,105	2,964	0	0	0	0	0	0	0	0
Aggressive	0	0	0	0	6,775	6,493	6,210	5,928	0	0	0	0	0	0	0	0
Residual																
Most Likely																
Aggressive																
Annual Acquired Savings																
Most Likely D	0	0	0	0	1,016	2,435	2,639	2,964	0	0	0	0	0	0	0	0
Aggressive D	0	0	0	0	2,032	4,869	5,279	5,928	0	0	0	0	0	0	0	0

MILESTONE	Period One to 2015	Period Two to 2020	Period Three to 2025	Period Four to 2030
Total Savings (GJ/yr.)				
Economic Potential	8,469	8,116	7,763	7,410
Most Likely	3,387	3,246	3,105	2,964
Aggressive	6,775	6,493	6,210	5,928
POTENTIAL SAVINGS ACQUISITION				
Accumulated Available				
Most Likely	3,387	3,246	3,105	2,964
Aggressive	6,775	6,493	6,210	5,928
Residual				
Most Likely	0	0	0	0
Aggressive	0	0	0	0
Annual Acquired Savings				
Most Likely D	1,016	2,435	2,639	2,964
Aggressive D	2,032	4,869	5,279	5,928

Energy-efficiency Measure	**M5a : Lumber Drying Kilns**															
Participant Definition	**Major retrofit of an efficient lumber dry kiln at sawmills and planer mills**															
Service Area	**Lower Mainland**				**N. Interior**				**S. Interior**				**Vancouver Island**			
Technology/Economic Potential Share	Upgrade To Efficient Lumber Dry Kiln - Base	100%			Upgrade To Efficient Lumber Dry Kiln - Base	100%			Upgrade To Efficient Lumber Dry Kiln - Base	100%			Upgrade To Efficient Lumber Dry Kiln - Base	100%		
Economic Potential Share	25%				49%				22%				4%			
MILESTONES	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**
Economic Potential Savings (GJ/yr.)	94,328	91,399	88,163	84,654	185,654	179,889	173,519	166,614	81,959	79,414	76,602	73,554	15,951	15,456	14,908	14,315
Participation Constraints	25%	15%	15%	15%	10%	10%	10%	10%	10%	10%	10%	10%	25%	15%	15%	15%
Economic Potential Available for DSM	70,746	77,689	74,938	71,956	167,089	161,900	156,167	149,952	73,763	71,473	68,942	66,198	11,963	13,137	12,672	12,168
Approximate Economic Potential Annual Savings per Project (GJ)	20,483				20,483				20,483				20,483			
Approximate Benefit-cost Ratio (Marginal Supply Cost of Gas ~$11/GJ)	5.1				5.1				5.1				3.3			
Approximate Customer Payback (Customer Cost of Gas ~$6/GJ)	4.0				4.0				4.0				4.0			
Participation Rate (% of Available Economic Potential)																
Most Likely	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%
Agressive	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%
Action Savings (GJ/yr.)																
Most Likely	42,448	46,614	44,963	43,174	100,253	97,140	93,700	89,971	44,258	42,884	41,365	39,719	7,178	7,882	7,603	7,301
Aggressive	56,597	62,151	59,951	57,565	133,671	129,520	124,934	119,962	59,011	57,178	55,154	52,959	9,571	10,510	10,138	9,734
Participation Rate (% of Total Economic Potential)																
Most Likely	45%	51%	51%	51%	54%	54%	54%	54%	54%	54%	54%	54%	45%	51%	51%	51%
Aggressive	60%	68%	68%	68%	72%	72%	72%	72%	72%	72%	72%	72%	60%	68%	68%	68%

MILESTONE	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**
Total Savings (GJ/yr.)																
Economic Potential	94,328	91,399	88,163	84,654	185,654	179,889	173,519	166,614	81,959	79,414	76,602	73,554	15,951	15,456	14,908	14,315
Most Likely	42,448	46,614	44,963	43,174	100,253	97,140	93,700	89,971	44,258	42,884	41,365	39,719	7,178	7,882	7,603	7,301
Aggressive	56,597	62,151	59,951	57,565	133,671	129,520	124,934	119,962	59,011	57,178	55,154	52,959	9,571	10,510	10,138	9,734
POTENTIAL SAVINGS ACQUISITION																
Accumulated Available																
Most Likely	42,448	46,614	44,963	43,174	100,253	97,140	93,700	89,971	44,258	42,884	41,365	39,719	7,178	7,882	7,603	7,301
Aggressive	56,597	62,151	59,951	57,565	133,671	129,520	124,934	119,962	59,011	57,178	55,154	52,959	9,571	10,510	10,138	9,734
Residual																
Most Likely																
Aggressive																
Annual Acquired Savings																
Most Likely A	10,612	23,307	33,722	43,174	25,063	48,570	70,275	89,971	11,065	21,442	31,024	39,719	1,794	3,941	5,702	7,301
Aggressive A	14,149	31,076	44,963	57,565	33,418	64,760	93,700	119,962	14,753	28,589	41,365	52,959	2,393	5,255	7,603	9,734

MILESTONE	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**
Total Savings (GJ/yr.)				
Economic Potential	377,892	366,158	353,193	339,137
Most Likely	194,137	194,520	187,632	180,165
Aggressive	258,849	259,360	250,176	240,220
POTENTIAL SAVINGS ACQUISITION				
Accumulated Available				
Most Likely	194,137	194,520	187,632	180,165
Aggressive	258,849	259,360	250,176	240,220
Residual				
Most Likely	0	0	0	0
Aggressive	0	0	0	0
Annual Acquired Savings				
Most Likely A	48,534	97,260	140,724	180,165
Aggressive A	64,712	129,680	187,632	240,220

Energy-efficiency Measure	**M5b : Veneer Drying Kilns**															
Participant Definition	**Major retrofit of an efficient veneer drying kiln at sawmills and planer mills**															
Service Area	**Lower Mainland**				**N. Interior**				**S. Interior**				**Vancouver Island**			
Technology/Economic Potential Share	Upgrade To Efficient Lumber Dry Kiln - Base			100%	Upgrade To Efficient Lumber Dry Kiln - Base			100%	Upgrade To Efficient Lumber Dry Kiln - Base			100%	Upgrade To Efficient Lumber Dry Kiln - Base			100%
Economic Potential Share	25%				49%				22%				4%			
MILESTONES	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**
Economic Potential Savings (GJ/yr.)	13,570	13,362	13,108	12,812	26,708	26,299	25,799	25,216	11,790	11,610	11,389	11,132	2,295	2,260	2,217	2,166
Participation Constraints	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%
Economic Potential Available for DSM	12,213	12,026	11,797	11,531	24,037	23,669	23,219	22,694	10,611	10,449	10,250	10,019	2,065	2,034	1,995	1,950
Approximate Economic Potential Annual Savings per Project (GJ)	11,880				11,880				11,880				11,880			
Approximate Benefit-cost Ratio (Marginal Supply Cost of Gas ~$11/GJ)	6.6				6.6				6.6				4.2			
Approximate Customer Payback (Customer Cost of Gas ~$6/GJ)	3.0				3.0				3.0				3.0			
Participation Rate (% of Available Economic Potential)																
Most Likely	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%
Agressive	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%
Action Savings (GJ/yr.)																
Most Likely	6,106	6,013	5,899	5,765	12,018	11,834	11,610	11,347	5,306	5,224	5,125	5,009	1,033	1,017	997	975
Aggressive	9,770	9,621	9,438	9,224	19,229	18,935	18,575	18,155	8,489	8,359	8,200	8,015	1,652	1,627	1,596	1,560
Participation Rate (% of Total Economic Potential)																
Most Likely	45%	45%	45%	45%	45%	45%	45%	45%	45%	45%	45%	45%	45%	45%	45%	45%
Aggressive	72%	72%	72%	72%	72%	72%	72%	72%	72%	72%	72%	72%	72%	72%	72%	72%
MILESTONE	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**
Total Savings (GJ/yr.)																
Economic Potential	13,570	13,362	13,108	12,812	26,708	26,299	25,799	25,216	11,790	11,610	11,389	11,132	2,295	2,260	2,217	2,166
Most Likely	6,106	6,013	5,899	5,765	12,018	11,834	11,610	11,347	5,306	5,224	5,125	5,009	1,033	1,017	997	975
Aggressive	9,770	9,621	9,438	9,224	19,229	18,935	18,575	18,155	8,489	8,359	8,200	8,015	1,652	1,627	1,596	1,560
POTENTIAL SAVINGS ACQUISITION																
Accumulated Available																
Most Likely	6,106	6,013	5,899	5,765	12,018	11,834	11,610	11,347	5,306	5,224	5,125	5,009	1,033	1,017	997	975
Aggressive	9,770	9,621	9,438	9,224	19,229	18,935	18,575	18,155	8,489	8,359	8,200	8,015	1,652	1,627	1,596	1,560
Residual																
Most Likely																
Aggressive																
Annual Acquired Savings																
Most Likely A	1,527	3,006	4,424	5,765	3,005	5,917	8,707	11,347	1,326	2,612	3,844	5,009	258	508	748	975
Aggressive A	2,443	4,810	7,078	9,224	4,807	9,468	13,931	18,155	2,122	4,180	6,150	8,015	413	813	1,197	1,560

MILESTONE	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**
Total Savings (GJ/yr.)				
Economic Potential	54,362	53,530	52,513	51,326
Most Likely	24,463	24,089	23,631	23,097
Aggressive	39,141	38,542	37,809	36,955
POTENTIAL SAVINGS ACQUISITION				
Accumulated Available				
Most Likely	24,463	24,089	23,631	23,097
Aggressive	39,141	38,542	37,809	36,955
Residual				
Most Likely	0	0	0	0
Aggressive	0	0	0	0
Annual Acquired Savings				
Most Likely A	6,116	12,044	17,723	23,097
Aggressive A	9,785	19,271	28,357	36,955

Energy-efficiency Measure	**M6 : Direct Fired**															
Participant Definition	**Asphalt Heating and Gypsum Drying**															
Service Area	**Lower Mainland**				**N. Interior**				**S. Interior**				**Vancouver Island**			
Technology/Economic Potential Share	Upgrade Gypsum Plant from 80% to 90%			100%	Upgrade Asphalt Hot Mix Plant		Baseline	100%	Upgrade Asphalt Hot Mix Plant		Baseline	100%	Upgrade Asphalt Hot Mix Plant		Baseline	100%
Economic Potential Share	78%				15%				1%				7%			
MILESTONES	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**
Economic Potential Savings (GJ/yr.)	196,778	186,897	177,777	169,343	36,722	35,264	33,906	32,641	3,156	3,014	2,882	2,759	16,470	15,985	15,528	15,096
Participation Constraints	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%
Economic Potential Available for DSM	177,100	168,207	159,999	152,409	33,050	31,737	30,516	29,377	2,840	2,712	2,594	2,484	14,823	14,387	13,975	13,586
Approximate Economic Potential Annual Savings per Project (GJ)	45,100,000				6,250				6,250				6,250			
Approximate Benefit-cost Ratio (Marginal Supply Cost of Gas ~$11/GJ)	7.3				5.3				5.3				5.5			
Approximate Customer Payback (Customer Cost of Gas ~$6/GJ)	3.8				3.8				3.8				2.3			
Participation Rate (% of Available Economic Potential)																
Most Likely	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%
Agressive	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Action Savings (GJ/yr.)																
Most Likely	88,550	84,104	79,999	76,204	16,525	15,869	15,258	14,689	1,420	1,356	1,297	1,242	7,412	7,193	6,988	6,793
Aggressive	177,100	168,207	159,999	152,409	33,050	31,737	30,516	29,377	2,840	2,712	2,594	2,484	14,823	14,387	13,975	13,586
Participation Rate (% of Total Economic Potential)																
Most Likely	45%	45%	45%	45%	45%	45%	45%	45%	45%	45%	45%	45%	45%	45%	45%	45%
Aggressive	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%
MILESTONE	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**
Total Savings (GJ/yr.)																
Economic Potential	196,778	186,897	177,777	169,343	36,722	35,264	33,906	32,641	3,156	3,014	2,882	2,759	16,470	15,985	15,528	15,096
Most Likely	88,550	84,104	79,999	76,204	16,525	15,869	15,258	14,689	1,420	1,356	1,297	1,242	7,412	7,193	6,988	6,793
Aggressive	177,100	168,207	159,999	152,409	33,050	31,737	30,516	29,377	2,840	2,712	2,594	2,484	14,823	14,387	13,975	13,586
POTENTIAL SAVINGS ACQUISITION																
Accumulated Available																
Most Likely	88,550	84,104	79,999	76,204	16,525	15,869	15,258	14,689	1,420	1,356	1,297	1,242	7,412	7,193	6,988	6,793
Aggressive	177,100	168,207	159,999	152,409	33,050	31,737	30,516	29,377	2,840	2,712	2,594	2,484	14,823	14,387	13,975	13,586
Residual																
Most Likely																
Aggressive																
Annual Acquired Savings (GJ)																
Most Likely D	26,565	63,078	68,000	76,204	4,957	11,901	12,969	14,689	426	1,017	1,102	1,242	2,224	5,395	5,939	6,793
Aggressive D	53,130	126,156	135,999	152,409	9,915	23,803	25,938	29,377	852	2,034	2,205	2,484	4,447	10,790	11,879	13,586

MILESTONE	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**
Total Savings (GJ/yr.)				
Economic Potential	253,126	241,160	230,093	219,840
Most Likely	113,907	108,522	103,542	98,928
Aggressive	227,814	217,044	207,083	197,856
POTENTIAL SAVINGS ACQUISITION				
Accumulated Available				
Most Likely	113,907	108,522	103,542	98,928
Aggressive	227,814	217,044	207,083	197,856
Residual				
Most Likely	0	0	0	0
Aggressive	0	0	0	0
Annual Acquired Savings (GJ)				
Most Likely D	34,172	81,391	88,010	98,928
Aggressive D	68,344	162,783	176,021	197,856

Energy-efficiency Measure	**M7 : Air Heaters**															
Participant Definition	**Comfort heat supply in High-bay locations**															
Service Area	**Lower Mainland**				**N. Interior**				**S. Interior**				**Vancouver Island**			
Technology/Economic Potential Share	High-efficiency Air Handling Units and Unit 50%				High-efficiency Air Handling Units and Unit 50%				High-efficiency Air Handling Units and Unit 50%				High-efficiency Air Handling Units and Unit 50%			
	Switch 3.3 MBTU Unit Heater to Direct Fired 50%				Switch 3.3 MBTU Unit Heater to Direct Fired 50%				Switch 3.3 MBTU Unit Heater to Direct Fired 50%				Switch 3.3 MBTU Unit Heater to Direct Fired 50%			
Economic Potential Share	57%				24%				14%				6%			
MILESTONES	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**
Economic Potential Savings (GJ/yr.)	280,259	278,669	276,943	275,133	116,245	114,911	113,647	112,458	66,792	65,064	63,436	61,906	28,746	27,452	26,238	25,100
Participation Constraints	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%
Economic Potential Available for DSM	252,233	250,802	249,249	247,620	104,621	103,420	102,282	101,212	60,113	58,557	57,092	55,715	25,871	24,707	23,614	22,590
Approximate Economic Potential Annual Savings per Project (GJ)	1,160				1,933				1,547				1,160			
Approximate Benefit-cost Ratio (Marginal Supply Cost of Gas ~$11/GJ)	3.5				5.8				4.6				3.6			
Approximate Customer Payback (Customer Cost of Gas ~$6/GJ)	7.3				4.4				5.5				4.5			
Participation Rate (% of Available Economic Potential)																
Most Likely	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%
Agressive	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Action Savings (GJ/yr.)																
Most Likely	201,786	200,642	199,399	198,096	83,696	82,736	81,826	80,970	48,090	46,846	45,674	44,572	20,697	19,766	18,891	18,072
Aggressive	252,233	250,802	249,249	247,620	104,621	103,420	102,282	101,212	60,113	58,557	57,092	55,715	25,871	24,707	23,614	22,590
Participation Rate (% of Total Economic Potential)																
Most Likely	72%	72%	72%	72%	72%	72%	72%	72%	72%	72%	72%	72%	72%	72%	72%	72%
Aggressive	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%
MILESTONE	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**
Total Savings (GJ/yr.)																
Economic Potential	280,259	278,669	276,943	275,133	116,245	114,911	113,647	112,458	66,792	65,064	63,436	61,906	28,746	27,452	26,238	25,100
Most Likely	201,786	200,642	199,399	198,096	83,696	82,736	81,826	80,970	48,090	46,846	45,674	44,572	20,697	19,766	18,891	18,072
Aggressive	252,233	250,802	249,249	247,620	104,621	103,420	102,282	101,212	60,113	58,557	57,092	55,715	25,871	24,707	23,614	22,590
POTENTIAL SAVINGS ACQUISITION																
Accumulated Available																
Most Likely	201,786	200,642	199,399	198,096	83,696	82,736	81,826	80,970	48,090	46,846	45,674	44,572	20,697	19,766	18,891	18,072
Aggressive	252,233	250,802	249,249	247,620	104,621	103,420	102,282	101,212	60,113	58,557	57,092	55,715	25,871	24,707	23,614	22,590
Residual																
Most Likely																
Aggressive																
Annual Acquired Savings																
Most Likely A	50,447	100,321	149,549	198,096	20,924	41,368	61,369	80,970	12,023	23,423	34,255	44,572	5,174	9,883	14,169	18,072
Aggressive A	63,058	125,401	186,937	247,620	26,155	51,710	76,712	101,212	15,028	29,279	42,819	55,715	6,468	12,353	17,711	22,590

MILESTONE	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**
Total Savings (GJ/yr.)				
Economic Potential	492,041	486,096	480,264	474,596
Most Likely	354,270	349,989	345,790	341,709
Aggressive	442,837	437,486	432,238	427,137
POTENTIAL SAVINGS ACQUISITION				
Accumulated Available				
Most Likely	354,270	349,989	345,790	341,709
Aggressive	442,837	437,486	432,238	427,137
Residual				
Most Likely	0	0	0	0
Aggressive	0	0	0	0
Annual Acquired Savings				
Most Likely A	88,567	174,994	259,343	341,709
Aggressive A	110,709	218,743	324,178	427,137

Energy-efficiency Measure	**M8 : Cement Kilns**															
Participant Definition	**Cement Plants**															
Service Area	**Lower Mainland**				**N. Interior**				**S. Interior**				**Vancouver Island**			
Technology/Economic Potential Share	Upgrade Cement Kiln Burners and Control; 100%				Upgrade Cement Kiln Burners and Control; 100%				Upgrade Cement Kiln Burners and Control; 100%				Upgrade Cement Kiln Burners and Control; 100%			
Economic Potential Share	88%				7%				5%				0%			
MILESTONES	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**
Economic Potential Savings (GJ/yr.)	56,385	51,388	46,745	42,433	4,365	3,978	3,619	3,285	3,204	2,920	2,656	2,411	0	0	0	0
Participation Constraints	20%	10%	10%	10%	20%	20%	20%	20%	20%	10%	10%	10%	20%	10%	10%	10%
Economic Potential Available for DSM	45,108	46,249	42,070	38,190	3,492	3,183	2,895	2,628	2,563	2,628	2,390	2,170	0	0	0	0
Approximate Economic Potential Annual Savings per Project (GJ)	22,000				22,000				22,000				22,000			
Approximate Benefit-cost Ratio (Marginal Supply Cost of Gas ~$11/GJ)	8.9				8.9				8.9				9.3			
Approximate Customer Payback (Customer Cost of Gas ~$6/GJ)	2.8				2.8				2.8				1.7			
Participation Rate (% of Available Economic Potential)																
Most Likely	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%
Agressive	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Action Savings (GJ/yr.)																
Most Likely	22,554	23,124	21,035	19,095	1,746	1,591	1,448	1,314	1,281	1,314	1,195	1,085	0	0	0	0
Aggressive	45,108	46,249	42,070	38,190	3,492	3,183	2,895	2,628	2,563	2,628	2,390	2,170	0	0	0	0
Participation Rate (% of Total Economic Potential)																
Most Likely	40%	45%	45%	45%	40%	40%	40%	40%	40%	45%	45%	45%	0%	0%	0%	0%
Aggressive	80%	90%	90%	90%	80%	80%	80%	80%	80%	90%	90%	90%	0%	0%	0%	0%
MILESTONE	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**
Total Savings (GJ/yr.)																
Economic Potential	56,385	51,388	46,745	42,433	4,365	3,978	3,619	3,285	3,204	2,920	2,656	2,411	0	0	0	0
Most Likely	22,554	23,124	21,035	19,095	1,746	1,591	1,448	1,314	1,281	1,314	1,195	1,085	0	0	0	0
Aggressive	45,108	46,249	42,070	38,190	3,492	3,183	2,895	2,628	2,563	2,628	2,390	2,170	0	0	0	0
POTENTIAL SAVINGS ACQUISITION																
Accumulated Available																
Most Likely	22,554	23,124	21,035	19,095	1,746	1,591	1,448	1,314	1,281	1,314	1,195	1,085	0	0	0	0
Aggressive	45,108	46,249	42,070	38,190	3,492	3,183	2,895	2,628	2,563	2,628	2,390	2,170	0	0	0	0
Residual																
Most Likely																
Aggressive																
Annual Acquired Savings																
Most Likely A	5,639	11,562	15,776	19,095	437	796	1,086	1,314	320	657	896	1,085	0	0	0	0
Aggressive C	2,255	20,812	29,449	38,190	175	1,432	2,027	2,628	128	1,182	1,673	2,170	0	0	0	0

MILESTONE	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**
Total Savings (GJ/yr.)				
Economic Potential	63,954	58,286	53,019	48,129
Most Likely	25,582	26,030	23,678	21,494
Aggressive	51,164	52,059	47,355	42,988
POTENTIAL SAVINGS ACQUISITION				
Accumulated Available				
Most Likely	25,582	26,030	23,678	21,494
Aggressive	51,164	52,059	47,355	42,988
Residual				
Most Likely	0	0	0	0
Aggressive	0	0	0	0
Annual Acquired Savings				
Most Likely A	6,395	13,015	17,758	21,494
Aggressive C	2,558	23,427	33,149	42,988

Energy-efficiency Measure	**M9 : Heat Treating**															
Participant Definition	**Foundries**															
Service Area	**Lower Mainland**				**N. Interior**				**S. Interior**				**Vancouver Island**			
Technology/Economic Potential Share	Heat Treating Furnace with Sequential 100%				Heat Treating Furnace with Sequential 100%				Heat Treating Furnace with Sequential 100%				Heat Treating Furnace with Sequential 100%			
Economic Potential Share	75%				20%				4%				1%			
MILESTONES	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**
Economic Potential Savings (GJ/yr.)	96,428	86,971	78,488	70,870	26,088	23,521	21,214	19,141	4,969	4,478	4,037	3,642	1,127	1,005	897	802
Participation Constraints	20%	10%	10%	10%	20%	10%	10%	10%	10%	10%	10%	10%	20%	10%	10%	10%
Economic Potential Available for DSM	77,142	78,274	70,639	63,783	20,870	21,169	19,093	17,227	4,472	4,030	3,634	3,278	902	905	808	722
Approximate Economic Potential Annual Savings per Project (GJ)	4,748				4,748				4,748				4,748			
Approximate Benefit-cost Ratio (Marginal Supply Cost of Gas ~$11/GJ)	6.6				6.6				6.6				4.2			
Approximate Customer Payback (Customer Cost of Gas ~$6/GJ)	3.0				3.0				3.0				3.0			
Participation Rate (% of Available Economic Potential)																
Most Likely	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%
Agressive	70%	70%	70%	70%	70%	70%	70%	70%	70%	70%	70%	70%	70%	70%	70%	70%
Action Savings (GJ/yr.)																
Most Likely	27,000	27,396	24,724	22,324	7,305	7,409	6,683	6,029	1,565	1,411	1,272	1,147	316	317	283	253
Aggressive	54,000	54,792	49,448	44,648	14,609	14,818	13,365	12,059	3,130	2,821	2,544	2,294	631	633	565	505
Participation Rate (% of Total Economic Potential)																
Most Likely	28%	32%	32%	32%	28%	32%	32%	32%	32%	32%	32%	32%	28%	32%	32%	32%
Aggressive	56%	63%	63%	63%	56%	63%	63%	63%	63%	63%	63%	63%	56%	63%	63%	63%
MILESTONE	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**
Total Savings (GJ/yr.)																
Economic Potential	96,428	86,971	78,488	70,870	26,088	23,521	21,214	19,141	4,969	4,478	4,037	3,642	1,127	1,005	897	802
Most Likely	27,000	27,396	24,724	22,324	7,305	7,409	6,683	6,029	1,565	1,411	1,272	1,147	316	317	283	253
Aggressive	54,000	54,792	49,448	44,648	14,609	14,818	13,365	12,059	3,130	2,821	2,544	2,294	631	633	565	505
POTENTIAL SAVINGS ACQUISITION																
Accumulated Available																
Most Likely	27,000	27,396	24,724	22,324	7,305	7,409	6,683	6,029	1,565	1,411	1,272	1,147	316	317	283	253
Aggressive	54,000	54,792	49,448	44,648	14,609	14,818	13,365	12,059	3,130	2,821	2,544	2,294	631	633	565	505
Residual																
Most Likely																
Aggressive																
Annual Acquired Savings																
Most Likely C	1,350	12,328	17,307	22,324	365	3,334	4,678	6,029	78	635	890	1,147	16	142	198	253
Aggressive C	2,700	24,656	34,613	44,648	730	6,668	9,356	12,059	157	1,269	1,781	2,294	32	285	396	505

MILESTONE	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**
Total Savings (GJ/yr.)				
Economic Potential	128,612	115,975	104,638	94,455
Most Likely	36,185	36,532	32,961	29,753
Aggressive	72,370	73,064	65,922	59,507
POTENTIAL SAVINGS ACQUISITION				
Accumulated Available				
Most Likely	36,185	36,532	32,961	29,753
Aggressive	72,370	73,064	65,922	59,507
Residual				
Most Likely	0	0	0	0
Aggressive	0	0	0	0
Annual Acquired Savings				
Most Likely C	1,809	16,439	23,073	29,753
Aggressive C	3,619	32,879	46,145	59,507

Energy-efficiency Measure	**M10 : Ovens**															
Participant Definition	**Batch, curing and drying processes**															
Service Area	**Lower Mainland**				**N. Interior**				**S. Interior**				**Vancouver Island**			
Technology/Economic Potential Share	Change to 45 MBTU High-efficiency Oven 100%				Change to 45 MBTU High-efficiency Oven 100%				Change to 45 MBTU High-efficiency Oven 100%				Change to 45 MBTU High-efficiency Oven 100%			
Economic Potential Share	87%				2%				11%				1%			
MILESTONES	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**
Economic Potential Savings (GJ/yr.)	25,951	25,349	24,746	24,140	525	516	506	496	3,212	3,141	3,071	3,000	168	157	147	137
Participation Constraints	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%
Economic Potential Available for DSM	23,356	22,815	22,271	21,726	473	464	455	447	2,891	2,827	2,764	2,700	151	141	132	123
Approximate Economic Potential Annual Savings per Project (GJ)	26				26				26				26			
Approximate Benefit-cost Ratio (Marginal Supply Cost of Gas ~$11/GJ)	6.6				6.6				6.6				4.2			
Approximate Customer Payback (Customer Cost of Gas ~$6/GJ)	3.0				3.0				3.0				3.0			
Participation Rate (% of Available Economic Potential)																
Most Likely	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%
Agressive	70%	70%	70%	70%	70%	70%	70%	70%	70%	70%	70%	70%	70%	70%	70%	70%
Action Savings (GJ/yr.)																
Most Likely	8,174	7,985	7,795	7,604	165	162	159	156	1,012	990	967	945	53	49	46	43
Aggressive	16,349	15,970	15,590	15,208	331	325	319	313	2,023	1,979	1,935	1,890	106	99	92	86
Participation Rate (% of Total Economic Potential)																
Most Likely	32%	32%	32%	32%	32%	32%	32%	32%	32%	32%	32%	32%	32%	32%	32%	32%
Aggressive	63%	63%	63%	63%	63%	63%	63%	63%	63%	63%	63%	63%	63%	63%	63%	63%
MILESTONE	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**
Total Savings (GJ/yr.)																
Economic Potential	25,951	25,349	24,746	24,140	525	516	506	496	3,212	3,141	3,071	3,000	168	157	147	137
Most Likely	8,174	7,985	7,795	7,604	165	162	159	156	1,012	990	967	945	53	49	46	43
Aggressive	16,349	15,970	15,590	15,208	331	325	319	313	2,023	1,979	1,935	1,890	106	99	92	86
POTENTIAL SAVINGS ACQUISITION																
Accumulated Available																
Most Likely	8,174	7,985	7,795	7,604	165	162	159	156	1,012	990	967	945	53	49	46	43
Aggressive	16,349	15,970	15,590	15,208	331	325	319	313	2,023	1,979	1,935	1,890	106	99	92	86
Residual																
Most Likely																
Aggressive																
Annual Acquired Savings																
Most Likely C	409	3,593	5,457	7,604	8	73	112	156	51	445	677	945	3	22	32	43
Aggressive C	817	7,187	10,913	15,208	17	146	223	313	101	891	1,354	1,890	5	45	65	86

MILESTONE	**Period One to 2015**	**Period Two to 2020**	**Period Three to 2025**	**Period Four to 2030**
Total Savings (GJ/yr.)				
Economic Potential	29,856	29,164	28,469	27,773
Most Likely	9,405	9,187	8,968	8,748
Aggressive	18,809	18,373	17,936	17,497
POTENTIAL SAVINGS ACQUISITION				
Accumulated Available				
Most Likely	9,405	9,187	8,968	8,748
Aggressive	18,809	18,373	17,936	17,497
Residual				
Most Likely	0	0	0	0
Aggressive	0	0	0	0
Annual Acquired Savings				
Most Likely C	470	4,134	6,278	8,748
Aggressive C	940	8,268	12,555	17,497

Conservation Potential Review – 2010 FortisBC

Impact of CPR-2010 Natural Gas Savings on the B.C. Economy (2010-2030)

Submitted to
FortisBC

Submitted by
ICF Marbek

in association with
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May 2011

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List of Exhibits

1 Introduction

In addition to energy savings, DSM programs can have broad impacts on the provincial economy as measured through metrics such as employment, GDP, and industrial output. Impacts arise from short term investment activities, such as building retrofits, and longer term changes in household/business spending, which can be attributed to the persistence of energy savings.

This analysis uses the results from the FortisBC Conservation Potential Review (CPR) Update 2010 to provide an estimate of the net macroeconomic impacts expected from implementing the achievable potential scenarios outlined in the main sector reports. The impacts reported in this analysis are specific to British Columbia and include the following measures of economic activity:

- Changes in Output (total industry revenues). This measures the value or amount of a good or service produced by an industry. This includes all production costs, including intermediate goods. Put differently, one can interpret output as the *total economic impact within an industry*.

- Changes in GDP at factor cost (total value-added at producers' prices, or total output minus costs of production). This is a measure of the value added to the economy and does not include the cost of resources consumed during production. One can interpret GDP at factor cost as a *net economic impact within an industry*. Based on these definitions, changes in output always exceed changes in GDP at factor cost. Finally, note that the term "net" used here is not the same as our use of "net" when referring to program impacts in the following section; net impacts of the DSM programs reflect changes in all industries rather than a single industry.

- Changes in employment (number of jobs).

The above economic impacts are reported for three sectors (residential, commercial and industrial) under the most likely and aggressive achievable potential scenarios at two milestone years: 2021 and 2030.

2 Approach

The analysis is based on the application of B.C. specific economic multipliers, which are a set of proportionality constants that relate changes in domestic production in a particular sector to its impacts on the entire B.C. economy. BC Stats released a report[1] in March 2008 documenting the British Columbia provincial economic multipliers based on 2004 economic data.

The multipliers contained in the BC Stats report noted above were applied to activities across all sectors that would be affected by the achievable potential results contained in each of the CPR sector reports. The impacts (both positive and negative) were then totalled to determine the net impacts, which are relative to the baseline scenario where no new DSM program initiatives are implemented by FortisBC. Essentially, ratepayer money is being shifted from a general basket of goods and services and applied to DSM program activities, which is modeled as a zero-sum situation.[2]

It should be noted that the effects of energy performance standards and naturally occurring market transformation induced by FortisBC's DSM programs, which increase program savings over time, are not included in the reported impacts; consequently the results presented are a conservative estimate of the overall impacts of natural gas energy efficiency initiatives.

The analysis was conducted in three steps:

1. A DSM mapping framework was created.
2. The investment (capital and labour) required by the DSM activities contained in each of the achievable potential scenarios was calculated and allocated into each category using the DSM framework established in Step 1.
3. Economic multipliers were applied, by category, to the investment amounts developed in Step 2.

Further discussion of each step is provided below.

2.1 Step 1: Create DSM Mapping Framework

The first step was to develop a framework to translate the CPR energy results into economic inputs. Exhibit 1 shows how the energy-efficiency investment activities represented by the CPR's achievable potential scenarios and the results from those activities are mapped to the appropriate economic categories contained in the B.C. economic model.

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[1] Garry Horne; *2004 British Columbia Provincial Economic Multipliers and How to Use Them;* BC Stats; March 2008.

[2] This is in contrast to "gross" impacts, which do not account for losses that occur as a result of activities modeled in the analysis. For example, the numbers reported in the BC Hydro analysis are gross and do not take into account the employment displaced due to potential supply-side projects avoided by DSM activities.

Exhibit 1 Map of DSM Activity to BC Stats Classification

BC Stats Classification	Description	CPR related DSM Activity
Induced impacts from wages and salaries (per CAN 2007$ saved)	General household spending in the economy is affected by the energy-efficiency strategy	▪ Increased disposable income from energy savings occurring in the year of analysis ▪ Increased ratepayer costs to fund DSM programs and incremental costs for the year of analysis
9 NATURAL GAS DISTRIBUTION, WATER, SEWAGE AND OTHER SYSTEMS	Lost utility revenue due to persistence of energy savings	Reduced final demand for gas distribution as a result of gas savings occurring in the year of analysis
10 CONSTRUCTION	Home weatherization and efficient whole building construction	Labour costs associated with construction and installation of measures in the year of analysis ▪ Building envelope ▪ Whole building measures ▪ Installation of equipment
22 NON-METALLIC MINERAL PRODUCT MANUFACTURING	Insulation materials	Production costs of ▪ Insulation measures (wall, roof, pipe, duct, DHW tank)
24 FABRICATED METAL PRODUCTS MANUFACTURING	Increased production of fabricated metal products	Production costs of ▪ Boilers, Condensing DHW boilers ▪ Heat recovery ▪ Faucet aerators ▪ Showerheads/Spray valves
25 MACHINERY MANUFACTURING	Increased production of machinery	Production costs of ▪ Rooftop units, Furnaces/Unit heaters ▪ Heat pumps ▪ CHP ▪ Pool heaters
27 ELECTRICAL EQUIPMENT, APPLIANCE AND COMPONENT MANUFACTURIN	Increased production of electrical equipment and appliances	Production costs of ▪ Ventilation /Fans ▪ Thermostat ▪ IR heaters ▪ Water heaters (all kinds)
31 WHOLESALE TRADE	Commercial/industrial equipment purchases go through wholesalers	Assume 15% wholesale margin
32 RETAIL TRADE	Residential equipment purchases go through retail store	Assume 15% retail margin
44 PROFESSIONAL, SCIENTIFIC AND TECHNICAL SERVICES	Program advertisement budget, consulting, implementation contractor	Assume 5% on top of equipment and labour annual investments
45 ADMINISTRATIVE AND SUPPORT SERVICES	Program admin budget	Assume 5% on top of equipment and labour annual investments

2.2 Step 2: Monetize Achievable Potential DSM Activities

Using the framework established in Step 1, inputs to the macroeconomic impact analysis were developed from the CPR results. The analysis first determined the monetary impact for each category in the preceding table for each scenario analyzed. The first category, wages and salaries, assumes that energy bill savings[3] from all sectors eventually result in changes to disposable spending. This can be approximated as an increase in wages/salaries. However, the increased disposable spending comes at a cost: lost utility revenue due to DSM activities.[4] This loss is captured in the second row of the table by the natural gas industry.

Note that we do not consider changes in utility rates over the study timeframe and assume that gas not consumed as a result of DSM programs is exported outside of the BC region. As FortisBC passes through commodity and midstream charges without mark-up, we gross down the expected lost revenue by the following percentages to get the gas distribution lost revenue portion of the total bill: 30% (residential), 27.5% (commercial), and 15% (industrial).[5]

All other categories represent investment activities that increase final demand for various goods and services. The level of investment was calculated based on the actual measures included in the achievable potential scenarios as reported in each of the sector reports. Incremental equipment and labour costs were reported separately for each measure. The model assumes that most residential equipment measures are purchased at retail stores while commercial and (most) industrial systems are purchased through wholesalers; the retail/wholesale margin of 15% is applied to the retail trade industry while the remaining 85% of consumer prices are allocated to the appropriate industries. For example, every $100 worth of showerheads purchased at the store, $15 was allocated to "retail trade" and $85 to "fabricated metal product manufacturing".

Investment activities related to the administration and implementation of the DSM programs are allocated to the following categories shown in Exhibit 1:

- 44 PROFESSIONAL, SCIENTIFIC AND TECHNICAL SERVICES and
- 45 ADMINISTRATIVE AND SUPPORT SERVICES.

The analysis assumes a combined overhead of 10% (5% Professional plus 5% Administrative) on the total installed costs described in the preceding Exhibit 1. This corresponds to 20% of program costs if Fortis' average conservation incentive is 50% of installed incremental cost. This level of administrative expense is consistent with other gas programs in North America.

Finally, the ratepayer experiences increased costs to cover the DSM programs and the incremental costs[6] of the efficiency activities.

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[3] Estimated by using the following rates: $9.2/GJ (commercial) and $9.8/GJ (residential) and $6.5/GJ (industrial). It is difficult to predict how the commercial and industrial bill savings would be re-spent in the regional economy so it is assumed that cost savings either get passed down to customers or to employees in the region.

[5] Based on current natural gas commodity rates, if rates were to increase then the percentage of the total bill represented by the volumetric delivery change would decrease.

[6] Depending on the application and replacement conditions, incremental and full costs may be equal.

2.3 Step 3: Apply Economic Multipliers

The final step involves application of the appropriate model multipliers to the monetized direct activities from the previous step; the multipliers used for each category are shown in Exhibit 2.[7]

Exhibit 2 Economic Multipliers

BC Stats Classification	Output/Revenue [8]	GDP at Factor Cost [9]	Employment [10] Per $1 million CAN $2007 saved
Induced impacts from wages and salaries	0.809	0.458	6.860
9 NATURAL GAS DISTRIBUTION, WATER, SEWAGE AND OTHER SYSTEMS	1.250	0.860	4.190
10 CONSTRUCTION	1.540	0.590	10.000
22 NON-METALLIC MINERAL PRODUCT MANUFACTURING	1.580	0.670	7.480
24 FABRICATED METAL PRODUCTS MANUFACTURING	1.300	0.560	7.090
25 MACHINERY MANUFACTURING	1.320	0.570	6.130
27 ELECTRICAL EQUIPMENT, APPLIANCE AND COMPONENT MANUFACTURIN	1.650	0.620	6.990
31 WHOLESALE TRADE	1.460	0.810	12.050
32 RETAIL TRADE	1.470	0.820	20.000
44 PROFESSIONAL, SCIENTIFIC AND TECHNICAL SERVICES	1.510	0.800	14.530
45 ADMINISTRATIVE AND SUPPORT SERVICES	1.480	0.830	23.100

The multipliers for output and GDP represent impacts on the entire economy due to an increase or decrease in domestic production. Multipliers for employment impacts are per one million dollars in direct changes to a category. For example, assume that an activity increases

[7] A comprehensive discussion of the BC multipliers is included in the previously cited report by Garry Horne.

[8] Multipliers are broken down into specific components (direct, indirect, induced, etc.) in the 2008 report. Industry multipliers for output are calculated from the report by combining direct and indirect multipliers (1+total indirect). Direct changes in output brought on by DSM activities are by default "one" and indirect changes in the rest of the economy are represented by "total indirect," which is provided in a table in the referenced report

[9] Multipliers for GDP and Employment are produced by adding the direct and total indirect components.

[10] Multipliers are for the scenario *With Safety Net*. As explained in the BC Stats report, this scenario assumes that those who lose their jobs stay in the province and collect unemployment insurance or other social assistance; new jobs are filled by people formerly receiving assistance. Since costs in the CPR are in $2011, we use the CPI inflation calculator to translate $2011 into $2007 before applying employment multipliers. www.bankofcanada.ca/en/rates/inflation_calc.html

output in the construction industry by $1 million. The total impacts on the BC economy would be:

- Output = $1 million x 1.540 = $1.540 million
- GDP = $1 million x 0.590 = $0.590 million
- Employment = $1 million x 10.00 jobs/$1 million = 10 jobs

3 Results and Conclusions

The results of the analysis are presented in the following exhibits:

- Exhibit 3 shows the economic impacts that occur in 2021, by sub sector and economic indicator for the most likely achievable scenario.
- Exhibit 4 shows the economic impacts that occur in 2021, by sub sector and economic indicator for the aggressive achievable scenario.
- Exhibit 5 shows the economic impacts that occur in 2030, by sub sector and economic indicator for the most likely achievable scenario.
- Exhibit 6 shows the economic impacts that occur 2030, by sub sector and economic indicator for the aggressive achievable scenario.

Annual DSM Expenditures are included in each table and include all ratepayer investments required for that benchmark year, which includes program administration/implementation, labour, and equipment costs. Energy savings for each year are also annual, but include savings from measures installed from previous years up to the useful lifetime.

Exhibit 3 Economic Impacts, 2021, Most Likely Achievable Scenario

Sector	Assumed Annual DSM Expenditure	Output	GDP	Employment
Residential	$45,675,316	$35,134,637	$11,374,417	207
Commercial	$9,303,164	$15,801,465	$6,226,142	132
Industrial	$4,009,526	$7,289,923	$3,100,698	56
Total	$58,988,006	$58,226,025	$20,701,256	394
Impact per $1 million spent on DSM		$987,082	$350,940	6.7

Exhibit 4 Economic Impacts, 2021, Aggressive Achievable Scenario

Sector	Assumed Annual DSM Expenditure	Output	GDP	Employment
Residential	$105,800,196	$79,764,622	$25,635,718	462
Commercial	$13,552,259	$22,386,788	$8,807,267	185
Industrial	$6,530,929	$11,686,748	$4,949,398	89
Total	$125,883,383	$113,838,158	$39,392,383	736
Impact per $1 million spent on DSM		$904,314	$312,928	5.8

Exhibit 5 Economic Impacts, 2030, Most Likely Achievable Scenario

Sector	Assumed Annual DSM Expenditure	Output	GDP	Employment
Residential	$47,759,079	$42,655,567	$14,663,414	289
Commercial	$12,323,293	$28,916,837	$12,182,648	266
Industrial	$3,901,902	$10,681,592	$4,918,478	88
Total	$63,984,274	$82,253,997	$31,764,540	643
Impact per $1 million spent on DSM		$1,285,535	$496,443	10.0

Exhibit 6 Economic Impacts, 2030, Aggressive Achievable Scenario

Sector	Assumed Annual DSM Expenditure	Output	GDP	Employment
Residential	$78,408,933	$71,870,330	$24,889,914	493
Commercial	$17,604,257	$39,554,252	$16,630,752	361
Industrial	$5,290,263	$14,495,051	$6,671,977	119
Total	$101,303,454	$125,919,633	$48,192,643	973
Impact per $1 million spent on DSM		$1,242,994	$475,726	9.6

3.1 Conclusions

The analysis determined that the *net* impacts of DSM programs are overwhelmingly positive for the regional economy as measured by output, GDP, and employment. As illustrated in the preceding exhibits:

- The net impacts on output, GDP, and employment are all positive across all sectors for every scenario. This occurs because the DSM program shifts spending from low multiplier industries to industries with higher multipliers.
- Annual impacts increase over time and are larger for the aggressive achievable scenarios. This arises due to the accumulation of energy savings from measures installed in prior years.
- The residential sector, in every scenario, accounts for the greatest share of economic impacts. This is most likely due to the early replacement measures in this sector.
- By 2021, the net employment gains from CPR activities will range between 362 - 682 jobs, depending on scenario. This translates to between 5.8 – 6.7 jobs per $1 million invested in DSM that year.
- By 2031 the net employment gains from CPR activities would grow to between 580 - 881 jobs, depending on scenario. This translates to between 9.6 – 10.0 jobs per $1 million

invested in DSM that year. The increase in number of jobs per $1 million invested in 2031 includes the beneficial effects of DSM investments made in prior years.

- Benefits will continue to accrue after 2030, due to investments made in prior years, until the effective life of the installed program measures has been exceeded.

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Project ID: 10041

Natural Gas Energy Efficiency Potential

Options to the TRC Benefit-Cost Test:

Workshop & Literature Review Summary

Submitted to
FortisBC

Submitted by
ICF Marbek
Habart & Associates
The Cadmus Group

June 2011

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Table of Contents

1 Introduction

1.1 Background

FortisBC[1] is conducting its Conservation Potential Review (CPR) – 2010 Update[2]. The completed CPR will provide FortisBC with a comprehensive planning document that the company can use on an ongoing basis to:

- Develop a long range energy efficiency (EE) strategy
- Design and implement energy efficiency programs
- Assess the impact of energy efficiency programs on both peak and annual load
- Assist the company to set its energy efficiency budgets
- Determine contribution EE programs can make towards meeting GHG reduction targets.

CPR studies, such as this one, provide a valuable basis for the identification of priority opportunities and for setting appropriate energy efficiency budgets and targets. Historically, the objective of utility operated energy efficiency programs was to capture short term, least-cost energy resources. However, more recently, a growing number of North American jurisdictions have expanded the objectives for these same energy efficiency programs to include carbon reduction targets intended to mitigate long term climate change impacts. The Province of British Columbia is a case in point. The Province has expanded energy efficiency objectives from "least cost" resource acquisition to carbon reduction and has set greenhouse gas (GHG) reduction targets of: a 33% reduction by 2020; and 80% reduction by 2050.

The Total Resource Cost (TRC) Test, which is one of the California Standard Tests (CSTs), has been widely used since the 1980s by North American utilities and regulatory bodies to determine cost-effective levels of EE investment. In that time EE initiatives have changed significantly in terms of both technologies and programs, and have expanded from a resource acquisition focus to market transformation. However the TRC test has not changed substantially in that time and, particularly as EE programs have become more aggressive, a growing number of EE practitioners have begun to identify challenges associated with reliance on the TRC test. These challenges become even more apparent as EE program objectives are expanded to address GHG reduction targets.

FortisBC is a case in point. The company has determined that the current British Columbia approach of using the TRC test as the screening mechanism for their energy efficiency and conservation (EEC) programs is limiting the scope of eligible programs that the company can provided to its customers in support of provincial energy efficiency and GHG reduction objectives.

The current British Columbia Government target for GHG reduction includes a 33% reduction from 2007 levels by 2020. If this objective is applied to the residential sector in B.C., a reduction in natural gas usage of about 28,000 TJ will be required. However, the recently completed Conservation Potential Review (CPR) has determined an economic potential of about 6,400 TJ,

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[1] FortisBC (formerly Terasen Gas) includes FortisBC Energy Inc.(FEI), FortisBC Energy (Vancouver Island) Inc. (FEVI) and FortisBC Energy (Whistler) Inc. (FEW).

[2] It should be emphasized that the achievable potential results contained in the CPR are not synonymous with either the setting of specific program targets or with program design. While both are closely linked to the discussion of achievable potential, they involve more detailed analysis that is beyond the scope of a CPR study.

for the residential sector or less than 1/4 the amount necessary to meet the target. Achievable potential will be less than this.

1.2 Objective

Given the above conditions, FortisBC asked ICF Marbek to undertake a high level review and assessment of potential alternate approaches for program screening that could better enable the company to support provincial energy GHG reduction objectives. In setting out to undertake the review, it was recognized that:

- A single "silver bullet" approach to this issue is unlikely; rather, it may be useful to consider a combination of alternatives.
- The potential alternate approaches are likely to vary in their difficulty, and possibly in the timeframe, required to implement them. Therefore the change may be a series of steps over time rather than one major change.
- Any proposed modifications to the program screening framework employed by FortisBC will require agreement between FortisBC and the B.C. Utility Commission (BCUC) as well as the EEC stakeholders, the provincial government and possibly interveners.

1.3 Approach

The review and assessment of alternatives was undertaken in four steps:

- Step 1: Conduct literature review: As noted above, challenges with the use of the TRC as an economic benefit-cost (B/C) screen for DSM (energy efficiency programs) and for meeting GHG reduction targets have been surfacing in other areas in Canada (e.g., Ontario) and in the United States. This first step, therefore, provided a review of the major literature and summarized the range of suggested alternatives suggested.
- Step 2: Identify & group possible alternatives: Based on the results of the literature review and discussions with colleagues in other jurisdictions, the identified alternatives were grouped into three sets of options for further discussion.
- Step 3: Conduct an options workshop: The consultants convened a half-day Benefit-Cost (B/C) workshop with senior FortisBC personnel. The workshop was organized into three components. They were:
  - ✓ An overview of the carbon gap challenge posed by relying on the TRC test to determine the scope of cost-effective EEC programs.
  - ✓ An options assessment. Each option was subjected to a facilitated discussion that sought to establish both its potential effectiveness and whether it represented a short or longer term mechanism.
  - ✓ A high level Action Plan. At the conclusion of the discussions, workshop participants identified the most promising options.
- Step 4: Summarize Workshop & Literature Review Results. The results of the workshop were documented into a short paper, augmented by an overview of the results of the literature review.

1.4 This Paper

This paper represents Step 4, as noted above. It provides a summary of the information presented in the half-day B/C workshop, including a broad outline of the resulting Action Plan.

The remainder of this paper is organized and presented in the following sections:

- Section 2 presents a high level overview of the tests currently used to assess energy efficiency and DSM program cost effectiveness, together with selected examples of the types of challenges encountered.
- Section 3 identifies critical inputs used in the traditional TRC analysis and presents a short discussion of alternative approaches to the selection of those inputs.
- Section 4 identifies two alternative cost-effective tests that could be used to replace the TRC test and provides a summary of the pros and cons of each test, as discussed during the workshop.
- Section 5 outlines a potential carbon-specific assessment option that could be used instead of the TRC test to determine desirable levels of energy efficiency or DSM investment.
- Section 6 provides a summary of the conclusions reached by workshop participants, including the most promising options and a proposed timeline for next steps.

2 Current Practice – Program Cost Effectiveness

2.1 Introduction

The workshop began with a brief overview of the current framework for conducting energy efficiency program cost-effectiveness tests. The discussion was organized as follows:

- California Standard Tests
- Issues and Challenges
- Potential Options

2.2 California Standard Tests (CST)

The California Standard Tests (CSTs) consist of a suite of tests designed to assess the benefits and costs of energy efficiency programs. They are intended to support economically efficient investment in the growth of energy supply by balancing investment in energy efficiency with investment in new supply. The California Standard Practice Manual describes five main cost effectiveness tests; the reason for the different tests is that cost-effectiveness can be viewed and assessed from multiple perspectives.

The common tests are shown in Exhibit 1, including the costs, benefits and discount rates typically included in each. The tests are:

- Total Resource Cost Test (TRC)
- Ratepayer Impact Test (RIM), also referred to as the non-participant test
- Utility Cost Test (UCT)[3]
- Participant Cost Test (PCT)
- Societal Cost Test (SCT)

Exhibit 1: California Standard Tests

	Elements	TRC	RIM	UCT	PCT	SCT
Benefits	Avoided Supply Costs	√	√	√		√
	Avoided T&D Costs	√	√	√		√
	Bill Reductions (Primary Fuel)				√	
	Conservation "Adder" or Externalities (Environmental)					√
	Indirect Fuel Benefits	√				√
	Bill Reductions (Indirect Fuel)				√	
	Other Indirect Benefits					√
Costs	Direct Utility Costs	√	√	√		√
	Direct Customer Costs	√			√	√
	Utility Program Administration	√	√	√		√
	Lost Revenues		√			
	Discount Rate	WACC	WACC	WACC	IDR	SDR

[3] Sometimes referred to as the Program Administrator Cost test in the literature.

All benefit-cost tests for EE programs are essentially similar. In each case, forecast benefits are divided by estimated costs to generate a benefit cost ratio. Each of the tests noted in Exhibit 1 assesses economic cost effectiveness from a differing perspective; hence, the differences in which benefits and costs are included in each test.

Exhibit 2 shows the distribution of cost effectiveness tests used in a number of jurisdictions, as summarized in a recent report prepared for the Ontario Energy Board[4]. As illustrated:

- The Total Resource Cost (TRC) is most widely used among North American utilities as the primary cost effectiveness test.
- Four of the jurisdictions used the Societal Cost test (SCT) exclusively and two jurisdictions used it in conjunction with the TRC test.
- The remaining tests are often applied as a secondary step to ensure that distributional effects are recognized and, as applicable, addressed through program design considerations.

Exhibit 2: Cost Effectiveness Tests Used in Different Jurisdictions

	TRC	Societal	Participant	Rate Payer	Utility	Program Admin
			UNITED STATES			
California	X					X
Colorado	X					
Connecticut	X				X	
Iowa		X	X	X	X	
Maine		X				
Massachusetts	X					
Minnesota		X	X	X	X	
New Jersey	X	X	X	X		X
New York	X					
Oregon		X			X	
Washington*						
Wisconsin	X					
			CANADA			
Alberta*						
British Columbia	X			X		
Manitoba	X	X				
Nova Scotia*						
Quebec	X					
			COUNTRIES OUTSIDE NORTH AMERICA			
Great Britain	X					
New Zealand*						
Australia*						

*Has not adopted formal DSM requirements for gas distributors.

2.3 Issues & Challenges

The California Standard Tests and the TRC in particular has been the primary test for assessing energy efficiency program cost-effectiveness for over two decades. However, as noted previously the literature review found that DSM practitioners and regulators throughout North

[4] Concentric Energy Advisors; Review of Demand Side Management (DSM) Framework for Natural Gas Distributors; prepared for the Ontario Energy Board, March 2010. Pg 42.

America have noted a number of fundamental problems with the EE program benefit-cost tests as commonly applied today.

The core issue in each case is that energy efficiency programs are increasingly being called upon to achieve the public policy goal of reduced carbon emissions. However, the benefit-cost analysis methods (i.e., the CST) that are commonly used to assess the cost-effectiveness of energy efficiency programs are not well suited to assessing this larger goal of carbon reduction and mitigation of climate change impacts. The situation is summarized in a paper prepared by Hall et al. The authors contend that policy makers continue to review energy efficiency programs under the TRC test, which fails to capture non-energy related benefits to society such as carbon reduction and national security. Consequently, the current approach requires energy efficiency to be cheaper than carbon-based resources before they can be approved, thus moving energy efficiency to a minor position in the supply mix. [5]

In short, the TRC was intended to support economically efficient investment in the growth of energy supply by balancing investment in energy efficiency with investment in new supply, not to determine levels of carbon reduction investment. FortisBC does currently include the cost of the carbon tax in the TRC calculations. However, the inclusion of a carbon tax is inadequate as a screening value as it is intended to discourage the use of carbon fuels, not to represent a value for carbon damage or mitigation.

The literature also notes that in addition to not providing an adequate screen for GHG reduction:

- The CST has fallen short of its intention to balance investment in efficiency with investment in new supply. It is generally recognized that, especially in the residential sector, non-energy benefits are a significant contribution to program participation, but are often not captured adequately in the screening process.

- There are significant issues in areas such as handling free riders and spillover that have hampered the development and evaluation of programs, thus eliminating some potentially good program opportunities.

- While the Total Resource Cost Test uses discounting to capture the time value of money, it is inadequate in capturing the generational equity issues surrounding GHG emissions and policy, and saving scarce fossil fuel resources for future generations.

2.4 Options

Assuming the continued inclusion of the carbon reduction goal as part of energy efficiency programs, three groups of options were identified:

- **Option1**: Use the Total Resource Cost Test – the test used in B.C. and most commonly throughout North America – but rethink the input values employed to better reflect the GHG reduction policy goal.

- **Option 2:** Use a different cost-effectiveness test from the CST suite – use a test other than the Total Resource Cost Test.

[5] See: Nick Hall, et al; *Reaching Our Energy Efficiency Potential and our Greenhouse Gas Objectives – Are Changes to our Policies and Cost Effectiveness Tests Needed?* ACEEE Presentation, March 2009.

- **Option 3:** Move beyond the California Standard Tests (CSTs) and identify a carbon-specific screening approach to meet the GHG reduction objective, or expand the CST to allow inclusion of GHG impacts in addition to the energy reduction benefits.

The following sections provide a summary of the literature search and workshop discussions related to each of the above Options.

3 Option 1: Change Inputs to TRC

3.1 Introduction

This section of the workshop briefly examined each of the major inputs to the TRC test individually, namely:

- Avoided/marginal costs
- Discount rate
- Treatment of free riders and spill over
- Treatment of non-energy benefits
- Program and measure life

In each case, the workshop discussion was organized into 3 parts:

- **The Issue:** What is the inherent contradiction or unintended effect from the current approach?

- **Potential Options**: What are the options identified in the literature that address the above issue(s); are there challenges associated with the options?

- **Impacts:** How significantly is the TRC result affected by the optional approach? For illustration purposes, the discussion in this section provides an estimate of the individual and cumulative impacts of the potential options using tankless water heaters as an example, where applicable.

3.2 Avoided/Marginal Costs

Under the TRC test, the benefits of DSM programs are defined as "avoided costs", which represent the benefit to society of not having to provide an extra unit of natural gas supply to the customer. Typically, in the natural gas industry avoided cost consists of the costs related to obtaining, transporting, and storing the gas commodity. Associated electricity and water costs are also often included.

3.2.1 The Issue

In most North American jurisdictions avoided cost values used in the TRC analysis continue to be derived based on the costs of carbon based fuels. This means that carbon based fuels continue to be the supply of choice unless energy efficiency is less expensive[6]. However, If the policy objective is to reduce GHGs rather than optimize the energy supply system, then the logic of screening the investments against the cost of additional fossil fuel based energy supply appears questionable.

The question is not, are GHG reduction programs less expensive than the cost of additional fossil fuels? Rather, the question becomes....."is this initiative less expensive than the impacts associated with releasing additional GHGs?" The challenge with this latter question is that there is no consensus on the future cost of the GHG impacts.

[6] See: Nick Hall, et al; *Reaching Our Energy Efficiency Potential and our Greenhouse Gas Objectives – Are Changes to our Policies and Cost Effectiveness Tests Needed?* ACEEE Presentation, March 2009.

In most North American jurisdictions avoided cost values used in the TRC analysis continue to be derived based on the costs of additional carbon based fuels or new electricity generation technologies. However many jurisdictions world-wide have introduced initiatives that impose higher marginal costs on new energy supply. For example:

- Many jurisdictions world-wide have introduced renewable portfolio standards (RPS) that define a minimum required share of renewable or clean energy in the overall supply mix. British Columbia's requirement for 93% renewable/clean electricity supply is a good example, as it imposes higher marginal costs on new energy supply.

- Other jurisdictions such as Ontario, the EU, Australia, China, Iran, Israel, and South Africa have added higher "feed-in" tariffs for alternate energy such as photovoltaic or wind power.

The issue then arises of whether DSM should be screened against the marginal sources of "conventional" supply or against these higher cost alternate energy sources. As DSM is typically the most environmentally benign way to meet the energy service needs of an economy, it makes sense to screen DSM programs against these alternate energy options that share similar environmental characteristics.

It should be noted that the definition of the Societal Cost Test contained in the California Standard Practice Manual allows the use of higher marginal costs if its costs are lower than other utilities in the state or than its out-of-state suppliers[7]. Applying the same logic to marginal costs of alternate energy appears to be a reasonable extension of the principle.

3.2.2 Options & Challenges

Given the recognized challenges of determining the future costs of GHG impacts, the workshop discussions focussed on alternative options. The discussions noted that if the policy objective is to reduce GHG emissions, then GHG reduction programs need to be screened against a carbon free (or at least carbon constrained) future energy supply system. This effectively means that avoided costs should more appropriately be tied to the cost of carbon free renewable energy alternatives.

In the case of FortisBC, biogas was cited as a renewable alternative that could serve as a starting point in this process. The current range of avoided costs for biogas and natural gas are shown below.

- Biogas – 2011 $9.90 GJ - $15.28 GJ
- Natural gas – 2011 $$7.03 GJ - $13.52 GJ

The $9.90/GJ price for biogas was derived from a blended weighted average of the two biogas contracts that FortisBC has finalized to date and been approved by the BC Utilities Commission. This is the current approved price for biomethane. The $15.28/GJ price for biogas was derived from BC Hydro's Tier 2 Residential Inclining Block (RIB) rate. This is the rate that BC Hydro residential customers pay when they exceed a certain consumption level per month. To come up with the $15.28/GJ price point, the BC Hydro Tier 2 RIB rate was converted to gigajoules, using a 90% efficiency factor, and all other charges that a residential customer would pay were removed except for the commodity charge.

[7] P19, "California Standard Practice Manual: Economic Analysis of Demand-Side Programs and Projects", July 2002

3.2.3 Impacts

As illustrated above, using the lower range cost of biogas supply to derive the applicable marginal supply cost for the TRC analysis instead of the current forecast natural gas supply costs would increase the value from $7.03/GJ to $15.28/GJ, a more that twofold increase.[8]

Tankless Water Heater Example

The impact of a change to the avoided supply cost was tested using the tankless water heater as an example. An avoided supply cost of $9.90/GJ was applied instead of the current forecast natural gas supply costs.
As illustrated below, the impact of this one change, alone, is to increase the benefit-cost ratio from a base case of .37 to .53.

- Possible 40% increase in marginal cost (MC)
- Tankless water heater
  - ✓ Base B/C 0.37
  - ✓ MC + 40% 0.53

3.2.4 Additional Considerations

The discussions also noted that the "pricing" for biogas noted above may still be conservative as it does not place any value on the fact that if the biogas is not converted to biomethane, some of the biogas would likely escape as methane, a much more harmful greenhouse gas than carbon dioxide.[9]

3.3 Discount rate

Discount rates are used in the benefit-cost analyses to bring all costs and returns occurring over different timeframes to a common net present value that enables different investment choices to be more fairly compared.[10]

3.3.1 The Issue

The current practice in most jurisdictions (and the one specified in the TRC test) is to use the weighted-average-cost of capital (WACC) as the discount rate. In most Canadian jurisdictions this value tends to be in the range of 7 to 9%, which is considerably higher than current interest rates available to individuals and businesses.

When higher discount rates are used in benefit-cost tests the benefits of future energy efficiency measures are significantly reduced. For example, as shown in Exhibit 3 below, when a discount rate of 9% is applied to a measure such as insulation, which has a 50 year life, the analysis only recognizes 22% of the measure's lifetime benefits. However, 100% of the cost is

---

8 The second impact of moving to a biogas marginal cost is that these costs are based on engineering projects and will provide a much more stable price than natural gas whose commodity price moves with supply and demand pressures in the North American market.

9 Some facilities (landfills & WWTPs) are under obligations to flare the biogas product so the emissions are CO_2.

10 The TRC specifies using the weighted cost of capital as the discount rate but the SCT allows the use of a social discount rate (SDR).

included in the analysis. Situations such as this example, have raised concerns that the future value of benefits attributed to energy savings is being significantly undervalued, especially if energy efficiency and conservation are intended to reduce carbon emissions and slow climate change.

As a case in point, the workshop discussions noted that in B.C., we currently have a situation with new construction programs where measures may reduce the utilities bills to the homeowner, but do not pass a utility B/C test. This occurs because mortgage rates are lower than FortisBC's discount rate, which are based on the WACC.

Hall et al. provide a good summary of the issue. The authors state that "discounting is especially problematic when the discount rate is not being applied to the value of increasingly severe projected global impacts or applied to all costs and all future benefits. Every deferral of an energy efficiency measure means that the corresponding carbon emissions will linger in the atmosphere for years or until we spend additional money to remove it with technologies yet to be developed. The damage will affect the current population somewhat, but is projected to affect future generations even more."[11]

3.3.2 Options & Challenges

The option advanced in the workshop is to select a discount rate that better matches the current application. At least in the short term use of a social discount rate was identified as the most appropriate option. In Canada there is currently a discussion regarding the appropriate level for a social discount rate.[12,13] For projects with intergenerational impacts the discussion suggests that the appropriate rate is between 1.5% and 3.5%.

Use of the social discount rate would:

- Better align with the broader carbon reduction objectives, as noted above.
- Recognize the significant intergenerational issues associated with GHG impacts. Although detailed investigation is beyond the scope of this study, it should be noted that there is a substantial body of theory related to the use of social discount rates; some goes as far as noting that considerations of intergenerational equity and environmental externalities can <u>theoretically</u> reduce the SDR to near zero or cause it to be negative.[14]

Hall et al also note the potential case for negative discount rates. The authors note that if energy efficiency and conservation are intended to reduce carbon emissions and slow climate change it is possible to suggest that the discount rate for climate change purposes should be negative resulting in a higher value allocated to future energy savings. In other words, the decision to approve energy efficiency programs should be more than just an assessment of

[11] Hall et al. op cit

[12] "**Social Discount Rates for Canada",** Anthony E. Boardman (UBC), Mark A. Moore (SFU), Aidan R. Vining (SFU). September 28, 2008.

[13] The Canadian Cost Benefit Analysis Guide of the Treasury states that a social discount rate of 3% can be used in certain cases where there are no or minimal resources involving opportunity costs. This applies to certain projects that generate human health and environmental impacts. Treasury Board of Canada Secretariat (TBS) "*Canadian Cost-benefit Analysis Guide: Regulatory Proposals"* PRI Project, 2007.

[14] See: Partha Dasgupta*, Karl-Göran Mäler**, and Scott Barrett; **Intergenerational Equity, Social Discount Rates and Global Warming;** ** April 2000

alternative financial outcomes and should recognize that the financial benefits of energy savings and carbon reduction increase over time.[15]

3.3.3 Impacts

Exhibit 3 shows that the choice of discount rate has a significant impact on cost-effectiveness, especially for measures that have a long life.

As illustrated below in Exhibit 3, the benefit cost analysis of a measure with a 50 year life would include 100% of the costs but only 22% of the benefits when a 9% discount rate is used. At a discount rate of 3%, the analysis would still capture 100% of the costs but benefits would increase to 51%. Although a significant improvement, even the 3% discount rate results in a significant reduction in NPV benefits relative to a discount rate of zero.

Exhibit 3: Discount Rate and Value of Measured Benefits

Tankless Water	**Measure Life**	**Discount Rate**					
		9.0%	**7.0%**	**5.0%**	**3.0%**	**1.0%**	**0.0%**
NPV Measure Benefits @$100 annual benefit stream	**5**	$389	$410	$433	$458	$485	$500
	10	$642	$702	$772	$853	$947	$1,000
	15	$806	$911	$1,038	$1,194	$1,387	$1,500
	20	$913	$1,059	$1,246	$1,488	$1,805	$2,000
	50	$1,096	$1,380	$1,826	$2,573	$3,920	$5,000
Percentage NPV Measure Benefit relative to zero discount rate	**5**	78%	82%	87%	92%	97%	
	10	64%	70%	77%	85%	95%	
	15	54%	61%	69%	80%	92%	
	20	46%	53%	62%	74%	90%	
	50	22%	28%	37%	51%	78%	

Heater Example

The impact of a change to the discount rate was tested, again using the same tankless water heater as an example. A social discount rate of 3.5% was applied instead of the WACC rate of 7.38%.

As illustrated below, the impact of this one change, alone, is to increase the benefit-cost ratio from a base case result of .37 to .57. When combined with the biogas based avoided supply price the combined impact is to increase the benefit-cost ratio .81.

- Base B/C 0.37
- 3.5% Social Discount Rate (“SDR”) 0.57
- Combined (SDR & MC) 0.81

[15] See concentric paper

3.4 Free Riders/Spillover

A free rider is a program participant who would have installed a measure on his or her own initiative even without the program. Spillover works in the opposite direction, and provides credit for savings from people who were influenced by the program, but who did not receive an incentive.

3.4.1 Issues

Typically, free rider participants are excluded from the benefits attributed to an EE program, along with the equipment costs associated with these participants. However, all the utility program costs associated with free riders are typically included in the TRC analysis. The net effect is to increase overall program costs and reduce cost-effectiveness. For example, the evaluation (2007) of FortisBC's furnace program set the free rider rate at >50%.

Spillover includes credit for additional measures that were undertaken by program participants but for which they did not receive an incentive, and also for other people who were influenced by the program (perhaps by advertising) but who also did not receive an incentive. In both cases their actions are wholly or partially induced by the utility program.

A previous study conducted for the Nevada Power Company and Sierra Pacific Power Collaborative included an examination of the treatment of free ridership and spillover in 23 states and/or utilities serving those states. The study concluded:[16]

- Estimating free ridership and spillover is difficult, with no consensus on an approach for how best to estimate these values. There are inherent biases with both self-report and statistical approaches, and the selection of one approach over another can give significantly different results. Ultimately multiple approaches may be necessary to satisfy all parties that the research is done correctly.
- Over two-thirds (69%) of the 23 identified programs used a net-to-gross value (NTG)[17] of approximately 1.0. In most cases lower NTG values were only based on free ridership values; an even higher percentage of programs would have a NTG ratio of approximately 1.0 if spillover was examined.

Assuming a NTG ratio of 1.0 may provide a conservative estimate. Since most existing studies concentrate on self-reported free ridership while ignoring spillover, it is possible that better, more comprehensive research would yield NTG ratios over 1.0.

Free ridership has been topical in recent months due to a series of press reports about the new compact fluorescent lamp (CFL) standards, and the reduction in NTG from program CFL program evaluations. Several researchers have found that states that do not have programs have sales of CFLs that are similar to those states that do. The conclusion from this data was that the CFL programs were not nearly as cost-effective as originally thought.

[16] A Study of Methodologies for Evaluating Free Ridership and Spillover throughout the United States." Draft Report to the Nevada Power/Sierra Pacific Power Collaborative Sub-Committee on Free Ridership and Spillover. Prepared by Paragon Consulting Services, Inc. November 20, 2006.

[17] Gross benefits are calculated without consideration of free rider or spillover effects, while net benefits include them. Net to gross (NTG)refers to the ratio of the two sets of results.

However, another reading of the same market data reveals that these freeriders could actually be considered spillover! A decade ago – right after the west coast power crises in the United States – western states enacted comprehensive CFL programs that spread to the Upper Midwest, New England, Texas and other U.S. regions. The programs involved both downstream and upstream market transformation programs, including chains such as Costco and Home Depot.

As the programs spread two things occurred: wholesale and retail rivals jumped on board with their own CFL promotions to combat market share losses, and national chains began making national decisions in response to the bottom-up program push from the individual states. It is therefore no surprise that states like South Dakota and Kansas – which have not had widespread utility CFL programs – have bulb sales rivaling neighboring states that do. What is surprising is that the sales in program states are now branded as having significant free ridership rather than the non-program states being referred to as spillover areas.

In summary,

- Use of the net-to-gross (NTG) ratio often becomes an analysis of negative free ridership, while the positive spillover effects (e.g., free drivers) are ignored.
- Even when spillover is calculated, it is often done only for participants' "other measures" installed. The effects of program advertising and information and their influences on nonparticipants are usually not studied.
- The bias is one directional; it consistently lowers the NTG ratio and reduces the cost effectiveness of EE programs.

3.4.2 Options & Challenges

Two options were identified; however, both present a number of challenges. More specifically:

- **Require full estimation of free ridership and spillover.** While in theory this provide the optimum solution, in practice it is very difficult, with no consensus on the approach for how best to estimate these values. More specifically, there are inherent biases with both self-report and statistical approaches, and the selection of one approach over another can give significantly different results. Similarly, the costs associated with a symmetrical assessment of both free rider and spillover effects could significantly increase program evaluation costs, threatening program cost-effectiveness.
- **Assume free riders and spillover cancel out, and do not need to be estimated**. As demonstrated previously, this is the current practice in a number of U.S. jurisdictions.

  While a case can be made for assuming that the two effects cancel each other, the challenge remains of how to do this while ensuring that program designs don't lead to high free ridership with little spillover?

  Part of the answer may be through use of higher incentives, trade ally training and technical support, streamlined participation processes and focus on longer payback initiatives. Ultimately, the key is ongoing research designed to measure market share changes so it is known when market transformation effects are realized.

3.4.3 Impacts

At a program level, impacts can be high. For example, as noted previously the evaluation (2007) of FortisBC's furnace program set the free rider rate at >50%.

3.5 Treatment of Non-Energy Benefits

Efficiency is rarely the only attribute of a product that is of interest to either consumers or sellers. In some initiatives such as windows and building shell upgrades, energy savings may be overshadowed by benefits such as comfort and appearance.

3.5.1 The Issue

Measuring and quantifying "non-energy benefits" is difficult and often controversial for regulators to accept as a legitimate factor to consider in utility regulation. As a result, non-energy benefits are seldom included in cost-effectiveness screening under the TRC or even under the Societal Cost Test. In contrast, the full retail cost of an efficiency investment is easy to quantify, and is virtually always used in benefit-cost analyses.

Nemes and Kushler note that:

- Some benefits are a natural by-product of the measure. For example, reducing the leakiness of a home improves comfort at the same time it saves energy.
- Similarly, more comfortable work environments have been shown to improve worker productivity.
- Efficiency and other desirable attributes are sometimes intentionally merged by manufacturers', designers' or builders as part of their marketing or sales strategies.
- Market players sell an "entry-level" product that is as basic and inexpensive as possible – usually meaning it is also inefficient; they also often bundle efficiency upgrades with other attractive features and market this bundle as a "premium" product.

The end result is that cost-effectiveness screening becomes an inherently skewed comparison: all the costs are compared to just a portion – i.e. the energy portion – of the benefits[18].

3.5.2 Options & Challenges

One option is to include non-energy benefits within the cost-effectiveness screening. Concentric Energy Advisors note in their report to the Ontario Energy Board that for the past decade in Massachusetts, the regulators have explicitly allowed the utilities to conduct studies of non resource benefits and include the value of such benefits in their cost-effectiveness screening. However, the Concentric Energy Report also notes that with rare exceptions, the utilities have not factored such benefits into their analyses. In the past, regulators in Washington, D.C. have allowed a non-resource benefit adder to be applied to low income programs. However, such examples are very rare. [19]

[18] Nemes and Kushler; op cit; pg 5.

[19] Concentric Energy Advisors; Review of Demand Side Management (DSM) Framework for Natural Gas Distributors; prepared for the Ontario Energy Board, March 2010.

Non-energy benefit studies have been done locally in the commercial sector, but these are both lengthy and expensive. The primary weakness is that the results have not been readily transferable to other situations. Some consideration is being given to developing “standard” non-energy benefits for limited residential applications such as increased comfort and house price / saleability for advanced new construction and retrofits.

A second option, which is discussed in Section 4, is to move to the Utility Cost Test (UCT), thereby avoiding the whole issue. Implicit in the UTC approach is the idea that consumers will decide what is in their own best interests, and will not be swayed into “overinvesting” in DSM just because there are incentives[20].

3.5.3 Impact(s)

The impact of improved inclusion of non-energy benefits varies by measure. It is expected to be particularly important for building shell measures, which provide added comfort and aesthetics.

As noted previously in Exhibit 3, the benefit cost analysis of a measure with a 50 year life would include 100% of the costs but only 22% of the benefits, when a 9% discount rate is used.

Tankless Water Heater Example

As noted previously, tankless water heaters currently have about a 7% market share in new construction, and an unknown, but possibly similar market share in retrofit. This indicates that some developers and individuals find sufficient benefit in the product to pay the increased cost (2 to 3 times the cost of a conventional tank). Many cite the benefit of “unlimited hot water” and floor space saved, but program planners would have difficulty justifying a “non-energy benefit” large enough to provide a positive benefit / cost ratio.

3.6 Program and Measure Life

Measure life, or effective useful life (EUL) is the period of time that the measure is expected to perform in a typical installation. It is commonly defined as the period over which 50% of the installed measures have either failed or been removed.

3.6.1 The Issue

Many jurisdictions tend to cap measure life at between 18 and 22 years regardless of the period of time the measure is expected to perform. This approach is often linked to a perceived need to be “conservative” in estimating life. However, the effect of this “conservatism” is to bias the choice to increased levels of new supply.

The issue of measure life and discount rate are closely linked; as illustrated previously, the use of discount rates in the range of 7 to 9% minimize the benefits of longer life measures past 20 or 25 years anyway.

As in the discussion of discount rates this issue most significantly impacts long-life measures such as building insulation and air sealing.

[20] For example, tankless water heaters will not save enough energy to cover the additional cost. There could be a back lash if consumers interpret the existence of the incentive to mean that the utility thinks that the cost savings will cover the additional costs.

Concentric Energy Advisors provide a good summary of this issue. Their report notes that vast amounts of energy savings in the United States become essentially worthless under standard benefit cost tests when savings occurring beyond the policy-based effective useful life period are not valued as a future energy resource. The authors contend that the majority of the value from savings on energy efficiency measures such as replacement windows, attic insulation, and new building envelopes is not recognized in benefit cost calculations because policy makers have underestimated the value of the long-term savings provided by those measures.[21]

3.6.2 Options & Challenges

A three step approach was identified:

- Use the “best estimate” of measure life
- If there is concern about the “best estimate” of life, use sensitivity analysis to determine the shortest measure life that provides a positive B/C
- Focus on discount rates, as the longer measure life only provides increased benefit with lower discount rates.

3.6.3 Impact(s)

The impact of improved inclusion of non-energy benefits varies by measure. It is expected to be particularly significant for building shell measures, which provide added comfort and aesthetics.

As noted previously in Exhibit 3, the benefit cost analysis of a measure with a 50 year life would include 100% of the costs but only 22% of the benefits, when a 9% discount rate is used.

[21] Concentric Energy Advisors; Review of Demand Side Management (DSM) Framework for Natural Gas Distributors; prepared for the Ontario Energy Board, March 2010.

4 Option 2: Change Benefit Cost Test

4.1 Introduction

This section provides an overview of the second set of options that were identified, namely: use a different cost-effectiveness test from the CST suite – use a test other than the Total Resource Cost Test. Two alternates to the TRC are reviewed:

- The Societal Cost Test
- The Utility Cost Test

In each case the idea is to work incrementally within the CST paradigm in an attempt to bridge the gap between GHG reduction and Energy Efficiency policies.

4.2 Societal Cost Test

The Societal Test is a variant on the TRC. It is intended to represent a broader societal view of cost-effectiveness. As shown previously in Exhibit 1, the SCT is the same as the TRC except that it adds environmental and other non-energy benefits and costs to society into the calculation.

The other differences are that the SCT allows for the use of alternate marginal costs and uses a social discount rate, rather than a WACC. Selected references for discount rates from other jurisdictions are listed below:

- In the US, Moore et al. (2004) propose a SDR of 3.5%
- Iowa and some other US states use long-term Treasury rates
- Government of Canada benchmark bond yields are 2.5 to 3.5% depending on series used and the time horizon
- Researchers at UBC / Simon Fraser are calling for Canadian SDRs that vary "between 2.0 and 5.0% for intragenerational projects, and between 1.5% and 3.5% for projects with intergenerational impacts"
- US Center for Disease Control (CDC) "recommends that a 3% social discount rate be used in analyses that require adjusting future costs and benefits of public health interventions, programs, and policies"
- UK is now using a 3.5% SDR
- In his now famous report on the economics of climate change, Stern (2006) uses a SDR of 1.3%.

4.2.1 Pros

Use of the Societal Cost Test would acknowledge the trend toward expansion of regulatory and policy objectives beyond reducing gas consumption or load management to also include GHG reduction and other societal goals, such as support for low income customers. The inclusion of environmental and social externalities in the SCT would:

- Allow better treatment of environmental impacts
- Allow use of a societal discount rate (1.5 - 3.5%)
- Allow the use of higher avoided supply costs, which would be consistent with the possible use of renewable energy supply costs such as biogas that have similar environmental attributes as DSM.

4.2.2 Cons

Although it addresses some non-energy benefits such as environmental externalities, other non-energy benefits such as improved comfort, building durability, health and safety, worker productivity, public image and others are seldom addressed. These issues remain the same as for the TRC.

4.3 Program Administrator/Utility Cost Test

The Program Administrator Cost Test (also referred to as the Utility Cost Test) measures cost-effectiveness from a utility or program administrator perspective. It compares the value of the utility's avoided costs with the cost to the utility of acquiring the efficiency resources that produce those avoided costs. It differs from the TRC in several ways:

- It does not include any energy benefits for fuels the utility does not provide
- It does not include any other resource benefits such as water savings; and
- It does not include any customer contributions to the cost of an efficiency investment. [22]

4.3.1 Pros

Proponents of the PAC test note that energy efficiency opportunities are not assessed in the same manner as energy supply alternatives**.** For example, Nemes and Kushler note that "when a regulator approves a utility purchased-power contract with a customer with an on-site generator, there is no consideration given to what the customer costs or other benefits from that equipment might be. All that is considered germane is the purchase price to the utility for that resource. The authors ask, "why should regulators apply a more stringent standard to utility investment in energy efficiency resources?" [23]

Use of the PAC also avoids the difficulties associated with attempting to calculate the value of non-energy benefits and respects the consumers' ability to make choices that are in their own best interests. It therefore enables utilities to promote technologies that do not pass traditional cost-effectiveness tests, such as the tankless water heaters that discussed as an example in this report.

4.3.2 Cons

The energy savings of some technologies that may be promoted by a utility program may not fully cover their incremental cost. The utility will need to be careful not to imply that any product it promotes will provide sufficient cost savings to cover the incremental costs.

[22] See: Chris Nemes, Marty Kushler; Is it Time to Ditch the TRC? Examining Concerns with Current Practice in Benefit- Cost Analysis; published in 2010 ACEEE Summer Study on Energy Efficiency in Buildings. 5-303.

[23] See: Chris Nemes, Marty Kushler; Is it Time to Ditch the TRC? Examining Concerns with Current Practice in Benefit- Cost Analysis; published in 2010 ACEEE Summer Study on Energy Efficiency in Buildings. 5-303.

5 Option 3: Use Carbon Based Screening

5.1 Introduction

As noted previously, if one of the objectives of utility DSM programs is to meet government mandated GHG reduction targets, then the approach used to screen DSM programs needs to shift the focus from the marginal cost of additional energy supply to the value of GHG reductions.

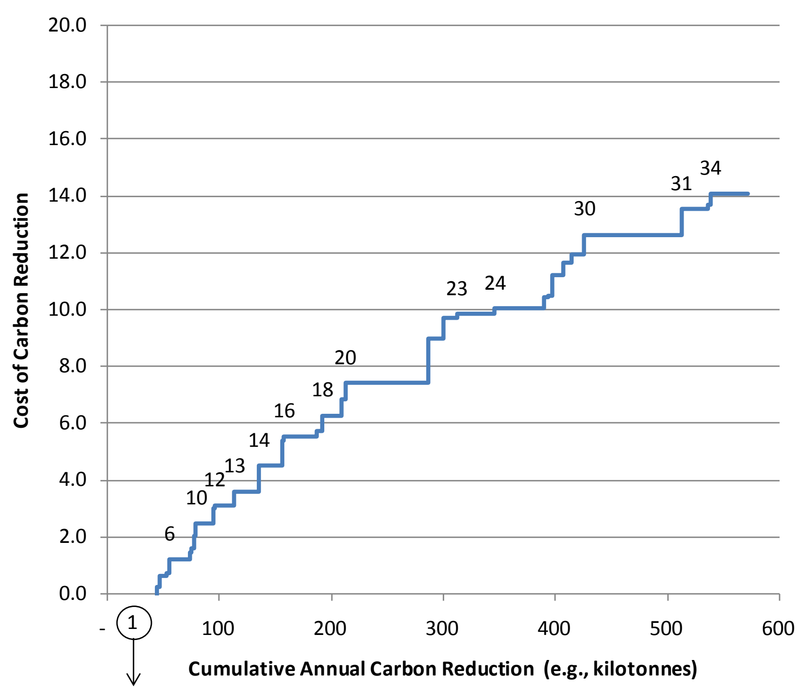
GHG reduction targets will require a reduction in the carbon intensity of our energy supply systems. On the one hand, as the amount of fuel required decreases, economics suggests that the marginal cost of that fuel will also decrease. On the other hand, the more "advanced" DSM measures needed to meet the GHG objectives will be progressively more expensive. If they are screened against a progressively lower MC of fuel, it is impossible to meet the GHG targets and move beyond the current level of DSM activity.

While studies have provided global estimates of the future costs of GHG impacts, there is a large range in potential values presented in these studies; moreover, there continues to be debate on the appropriate approach to be applied to these analyses. Consequently, it is evident that determining an agreed "value" for the cost of GHG emissions to be used in benefit cost analyses such those discussed in this paper is likely to be a lengthy and controversial process.

5.2 An Alternate Approach

Rather than attempting to determine a value for GHG reduction and then screen against it, an alternate approach is to build a "supply curve" of GHG reduction measures. This approach is an adaptation of "energy supply curves" that commonly included in energy efficiency market potential studies. Exhibit 4 provides an illustration.

Exhibit 4: Carbon Reduction Supply Curves – An Illustration



As illustrated in Exhibit 4, each step in the GHG reduction curve shows the cumulative amount of GHG reduction that could be achieved by each of the numbered measures and the associated cost. The measures in Exhibit 4 are organized from least cost to more expensive. Whereas conventional energy efficiency program screening would limit the inclusion of measures to those that met the marginal cost threshold, the approach shown in Exhibit 4 is to include all measures while noting their successively higher costs.

The detailed analysis of energy savings opportunities contained in the FortisBC Conservation Potential Review provides an opportune starting point for the construction of a carbon reduction supply curve. The detailed analysis of the FortisBC CPR identifies a wide range of measures together with the total amount of potential energy savings and associated costs for each. The amount of GHG reduction associated with each energy saving measure can also be readily calculated, which allows the construction of a GHG supply curve such as that shown in Exhibit 4.

Once the curve has been developed, it will identify the scope of GHG reduction potential at each cost point. This will provide the basis for discussions among the utility, the provincial government (who set the GHG reduction targets) and possibly the regulator to set the cost threshold and matching GHG reduction objectives.

One interesting aspect of this curve is that some part of the GHG reductions will be “free” in that they will be paid via the current DSM funding approach. That is, that portion of the curve or those measures that are cost effective from the TRC or SOC screening perspective can be obtained at no additional cost to society.

However for measures that are above this level, there is an additional cost that must be borne by society. This will likely lead to discussions of who should pay these costs, how programs are fund, approved, etc.

5.2.1 Additional Considerations

There may be an interim approach to approving programs that have GHG benefits but do not pass the TRC / SOC screening. The concept is to screen the program by DSM standards, and then determine the extent that the DSM costs exceed the DSM benefits, divide this by the GHG reduction and determine if the cost per ton of GHG reduction is less than the agreed threshold. If this test is met, then the program would be allowed to proceed.

5.3 Potential Benefits

This alternate approach outlined above has a number of potential benefits:

- It clearly accounts for the share of the program and incentive cost that is “paid for” by the DSM energy savings.
- It makes the cost of the GHG reduction explicit.
- It is an “add-on” to the CST tests, and as such may be easier to get agreement to than developing a completely new screening technology.
- It avoids having to develop a “definitive” value for GHGs which would be necessary if the value of GHG savings were to be included in an SOC type approach.

- It somewhat avoids the issue of “who should pay” in that the additional cost would be borne by the program participants (as opposed to general ratepayers or utility customers). The cost is carried by the program participant, who is free to join the program or not. This avoids any additional “non-participant” type issues. In some ways this is very similar to the “non-energy benefits”, and recognizes that people invest in measures or programs for a wide range of reasons, cost / benefit being only one, and perhaps a minor one.

- It protects the utilities financial ROI model for DSM. They still fund the programs and obtain ROI in the same manner as with current programs. However they will now be able to promote a wider range of programs.

6 High Level Action Plan

Exhibit 5 presents a summary of the Action Plan or next steps as developed through the workshop and in subsequent discussions within FortisBC

Exhibit 5: High Level Action Plan

Option	Workshop Conclusion/Recommendation
Change Inputs to TRC	
✓ Marginal Cost	✓ Internal agreement to use long term cost of biogas to set marginal supply cost, subject to regulator approval
✓ Discount Rate	✓ Internal agreement to move to social discount rate of 3.0% subject to regulator approval
✓ Free Riders//Spillover	✓ Apply to regulator for approval to treat as "net zero"
✓ Non-energy benefits	✓ Work towards stipulated NEB for some programs (esp. Building shell)
✓ Measure life	✓ Use full measure life
Change BC Test	
✓ Use SCT	✓ Apply to regulator to move to SCT including above inputs
✓ Use UCT	Not a priority; no further action
Use GHG Based Approach	Prepare Carbon Abatement Cost Curves – 3 sectors
	✓ Engage MEMPR / regulator to agree on maximum social value for GHG reduction from programs
	✓ Apply to regulator to include GHG reduction benefit as part of EEC program screening
Short Term Action Plan	✓ Apply to regulator to move to SCT as part of 2011 RRA
	✓ Develop Carbon Abatement Cost Curves - summer 2011
	✓ Discuss GHG approach with BC Gov't – fall 2011
	✓ Apply to regulator to include GHG in EEC program screening – date not determined

Attachment 196.1

REFER TO LIVE SPREADSHEET MODELS

Provided in electronic format only

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(accessible by opening the Attachments Tab in Adobe)

Attachment 197.2

ENERGY EFFICIENCY POLICY MANUAL, VERSION 4.0

(July 2008)

Applicable to post-2005 Energy Efficiency Programs

EE Policy Manual Version 4.0

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3. Energy Savings Goals, D.04-09-060
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6. LT Avoided Cost Methodology and E3 Calculators
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Table - Fund Shifting Rules
Graphic - Shareholder Incentive Mechanism Graphic Illustration

APPENDIX B – GLOSSARY

Common EE Terms and Definitions

Adopted Program Budget	Free Riders (ridership)	Peer Review Group (PRG)
Advanced Technologies	Fuel Substitution	Performance Basis
Affiliate	Funding Cycle	Performance Earnings Basis (PEB)
Avoided Costs	Gas Savings	
Baseline Data	Hard To Reach, Non Residential	Performance Uncertainties
Coincident Peak Demand	Hard To Reach, Residential	Portfolio
Community Choice Aggregators		Portfolio Reporting
Competitive Solicitation	Incremental Measure Cost	Pre-commercialization
Conservation	Information and Education Programs	Program
Conservation Measures	Innovation Incubator	Program Activities
Conservation Programs	Institutional Barriers	Program Administrator
Cost Effectiveness	Least Cost/Best Fit	Program Administrator Cost Test (PAC)
Cream Skimming	Levelized Cost	Program Advisory Group PAG)
Cross Subsidization	Load Management	Program Cycle
Customer	Load Serving Entities	Program Implementers
Dual Test	Lost Opportunities	Program Strategy
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Energy Efficiency Groupware Application 2006 (EEGA)	Non-price Factors	Service Area
End Use	Operating Program Budget	Short Term/Long Term
Energy Efficiency	Participant Test	Source BTU Consumption
Energy Efficiency Measure	Partnership	Spillover
Energy Efficiency Program	Peak Demand	Standard Practice Manual
Energy Efficiency Savings	Peak Demand, Coincident	Statewide
Evaluation, Measurement and Verification (EM&V)	Peak Demand (General)	Third Party/Non-IOU
Evaluation Project Budget	Peak Savings, Coincident (kW)	Total Resource Cost Test (TRC)
Financial Incentive	Peak Savings – Daily Average (kW)	
Free Drivers	Peak Savings, Non Coincident	Zero Net Energy

**ENERGY EFFICIENCY POLICY MANUAL
FOR POST-2005 PROGRAMS**

I. Introduction

This document presents the California Public Utilities Commission's (Commission) policy rules and related reference documents for the development and evaluation of energy efficiency programs funded by ratepayers in California. Referred to as the Energy Efficiency Policy Manual, Version 4.0, this document shall apply to all energy efficiency activities commencing in program year (PY) 2005 and beyond. The policy rules, terms and definitions contained herein apply to energy efficiency activities funded through the following mechanisms:

- The electric public goods charge (PGC), as authorized by Public Utilities (PU) Code Sections 381 and 399.
- The gas surcharge, as authorized by PU Code Sections 890-900.
- Procurement rates, as authorized by the Commission.

The rules in this manual do **not** currently apply to:

- Low-income energy efficiency programs (LIEE) funded by the electric PGC or gas surcharges
- California Alternative Rates for Energy (CARE) for low-income customers funded out of electric or gas PGC[1]
- Interruptible rate or load management programs[2]
- Self-generation and demand-responsiveness programs developed in response to AB970 (PU Code Section 399.15(b)).[3]

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[1] A separate low-income rulemaking was initiated on January 25, 2007 (R.07-01-042).

[2] Interruptible and load management programs are addressed under Decision 05-11-009 (R.02-06-001).

[3] These programs were adopted in D.01-03-073, in R.98-07-037.

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This document supersedes all previous versions of the Energy Efficiency Policy Manual. Sections II-XI below articulate the Commission's policy rules ("Rules") governing energy efficiency activities, commencing in 2006.

The term "Program Administrators" refers to the following investor-owned utilities (IOUs): Pacific Gas and Electric Company (PG&E), Southern California Edison Company (SCE), San Diego Gas & Electric Company (SDG&E) and Southern California Gas Company (SoCalGas).

II. Energy Efficiency Policy Objectives and Program Funding Guidelines

1. Commission and state energy policy, as expressed in the Energy Action Plan and reaffirmed in Decision (D.) 04-12-048, make energy efficiency the utilities' highest priority procurement resource. In other words, cost-effective energy efficiency should be first in the "loading order" of resources used by the utilities to meet their customers' energy service needs. The Governor's and the state's policies also seek to reduce the environmental impact (including the greenhouse gas emissions) associated with the state's energy consumption, to protect the public's health and safety. Energy efficiency is a critical part of the state's strategy to achieve these goals.

1.a. For PY2009 and through 2020 and beyond, the utilities shall develop a single, comprehensive Strategic Plan updated annually for energy efficiency programs and program cycles. The plan shall incorporate collaboration with a wider range of stakeholders, integration with other demand-side management programs, and innovation of energy efficiency programs, as outlined under D.07-10-032. The utilities shall aggressively pursue energy efficiency as part of the Western Regional Climate Action Initiative, February 26, 2007 and the National Action Plan for Energy Efficiency (See http://www.epa.gov/solar/energy-programs/napee/index.html).

2. The Commission's overriding goal guiding its energy efficiency efforts is to pursue all cost-effective energy efficiency opportunities over both the short- and long-term. By D.04-09-060, the Commission translated this policy into specific annual and cumulative numerical goals for electricity and natural gas savings by utility service territory. These goals shall be updated periodically by the Commission as provided for in that decision. The Commission-adopted energy savings goals are expressed in terms of annual and cumulative gigawatt hours, million-therms and peak megawatt load reductions. By D.06-06-063, Ordering Paragraph 1, the definition of peak megawatt load reduction contained

in the 2005 Database for Energy Efficient Resources (DEER) shall be used for the purpose of verifying energy efficiency program and portfolio performance[4]. Program Administrators should develop their energy efficiency program portfolios so that they will meet or exceed these annual and cumulative savings goals, both over the short- and long-term.[5] As clarified in D.07-10-032, cumulative savings represent the savings in that year from all previous measure installations (and reflecting any persistence decay that has occurred since the measures were installed) plus the first-year savings of the measures installed in that program year.

3. In order to promote the resource procurement policies articulated in the Energy Action Plan and by this Commission, energy efficiency activities funded by ratepayers should focus on programs that serve as alternatives to more costly supply-side resource options ("resource programs"). Focusing energy efficiency efforts in this way is the most equitable way to distribute program benefits: By keeping energy resource procurement costs as low as possible through the deployment of cost-effective portfolio of resource programs, over time *all* customers will share in the resource savings from energy efficiency.

4. "Lost opportunities" are those energy efficiency options which offer long-lived, cost-effective savings and which, if not exploited promptly or simultaneously with other low cost energy efficiency measures or in tandem with other load-reduction technologies or distributed generation technologies being installed at the site (e.g., solar heating or photovoltaics), are lost irretrievably or rendered much more costly to achieve. "Cream skimming" results in the pursuit of only the lowest cost energy efficiency measures, leaving behind other cost-effective opportunities. Cream skimming becomes a problem when lost opportunities are created in the process.

5. Program Administrators should manage their portfolio of programs to meet or exceed the short- and long-term savings goals established by the

[4] D.06-06-063. As discussed in this decision, DEER defines peak demand as the average grid level impact for a measure between 2 p.m. and 5 p.m. during the three consecutive weekday periods containing the weekday temperature with the hottest temperature of the year.

[5] While the energy savings achieved by LIEE programs will count towards the Commission's savings goals, per D.04-09-050, the Commission considers factors other than cost-effectiveness in determining LIEE program design and funding levels.

Commission by pursuing the most cost-effective energy efficiency resource programs first, while minimizing lost opportunities. In addition, the Program Administrators should demonstrate in their program planning applications how their proposed portfolio will aggressively increase overall capacity utilization and lower peak loads through the deployment of low load factor/high critical peak saving measures. The aggressive annual and cumulative savings goals established by the Commission will serve to discourage cream- skimming program designs or implementation approaches that create lost opportunities. Nonetheless, Program Administrators should actively develop strategies to minimize lost opportunities, and should describe those strategies in the applications they submit for each program cycle.

6. Compliance with Rule II.5 will generally dictate the appropriate balance for portfolio funding of resource programs across market sectors (e.g., residential, industrial, commercial) and geography, as well as the most appropriate program designs. Program Administrators should also include a selection of statewide marketing and outreach programs, upstream market transformation programs, information and education programs, support for codes and standards and other activities in their proposed portfolios that support the Commission's short-term and long-term energy savings goals. Program administrators shall allocate a sufficient portion of portfolio funding to statewide marketing and outreach to continue and build upon the success of the existing program. Statewide marketing and outreach programs should convey a consistent statewide message to energy consumers in all sectors.

7. To further support the Governor's and State's goals to reduce greenhouse gas emissions, Program Administrators should explore with their advisory groups ways in which to co-brand with the California Climate Action Registry that will encourage the accurate reporting of emissions in California. This might include, for example, marketing and outreach efforts that provide information about the Registry to IOU customers and encourage larger commercial and industrial customers to participate in the Registry reporting protocols. In their program plan applications, Program Administrators shall describe the ways in which such co-branding will be supported through their proposed programs. Similarly, energy efficiency marketing efforts should strive to co-brand with water conservation messaging, recycling, toxic reductions (particularly mercury from fluorescent lamps), solar, distributed generation, green buildings, low income, and other related programs. (D07-10-043, mimeo p. 59)

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8. The deployment of new and improved energy efficiency products and applications can help sustain or increase current savings yields from program dollars, and serves to create a new generation of technologies available to tap the cost-effective potential of energy efficiency in ways we cannot predict today. In order to provide higher levels of bridging between available upstream innovations and the marketplace, annual funding for emerging technologies programs should increase. Program Administrators should work with the California Energy Commission (CEC) and other appropriate stakeholders to include appropriate levels of funding to demonstrate and commercialize emerging technologies funded through the California Public Interest Energy Research (PIER) program and other sources that otherwise would not receive funding for pre-commercialization demonstration. In their program planning applications, the Program Administrators shall jointly propose emerging technologies programs and increases to current funding levels for these programs. The main purpose of these programs should be to increase the probability that promising technologies will be commercialized within 6 years of program funding and thereby increase the chance of obtaining additional energy savings from these technologies in the long run. Program strategies should focus on reducing both the performance uncertainties associated with new products and applications and the institutional barriers to introducing them into the market.

9. Per D. 05-01-055, Program Administrators with input from the public and advisory groups will develop for Commission consideration their portfolios of energy efficiency programs utilizing selection criteria that are consistent with these Rules. Program Administrators will manage a portfolio of programs implemented by IOUs and non-IOUs that are selected and evaluated based on their ability to best meet the policy objectives articulated in these Rules.

10. Pursuant to PU Code sections 381, 381.1[6], 399 and 890-900, PGC and gas surcharge funds must be spent to deliver energy efficiency benefits to ratepayers in the service territory from which the funds were collected.

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[6] Consistent with the provisions of AB117 (Chapter 838, Chaptered September 24, 2002), Section 381.1 was added to Public Utilities Code permitting community choice aggregators (CCAs) to apply to administer cost-effective energy efficiency and conservation programs. The Commission adopted certain procedures in Decision (D.) 03-07-034 (dated July 10, 2003) to implement portions of AB 117 affecting the allocation of energy efficiency program funds. [MOVED FROM FOOTNOTE 1]

Additionally, gas PGC collections must fund natural gas energy efficiency programs and electric PGC collections must fund electric energy efficiency programs. However, nothing in these Rules is intended to prohibit or limit the ability of the Commission to direct the IOUs to jointly fund with PGC, gas surcharges, or other collections (e.g., via procurement rates) selected measurement studies, statewide marketing and outreach programs, or other energy-efficiency activities that reach across service territory boundaries.

11. Fund Shifting Rules (D.05-09-043, Table 8) applicable to the 2006-2008 program cycle are added to these Policy Rules as an attachment to Appendix A. Appendix A is modified per D.07-10-032 for carry-back/carry-over funding to apply to the 2009-2011 funding cycle, and is repeated below.

12. Bridge Funding. Programs continuing from the 2006-2008 program cycle into the 2009-2011 cycle may use 2009-2011 funding, once the 2009-2011 portfolio has been approved and start-up costs for 2009-2011 programs may use 2009-2011 funding once the 2009-2011 portfolio has been approved. (D.07-10-032). Unspent or uncommitted funds from previous program years, or 2006-2008 funds that will not be needed should be used prior to using 2009-2011 funds. Both continuing program funding and start-up cost funding are limited to 15% of the current budget cycle without Commission approval. An Advice Letter is required for funding in excess of this percentage.

13. Funds may be committed for projects with lead times beyond three years under the following conditions:

- Long-term projects that require funding beyond the three-year program cycle shall be specifically identified in the utility portfolio plans and shall include an estimate of the total costs broken down by year and associated energy savings;
- Funds for long-term projects must be actually encumbered in the current program cycle;
- Contracts with all types of implementing agencies and businesses must explicitly allow completion of work beyond the end of a program cycle;
- Encumbered funds may not exceed 20% of the value of the current program cycle budget to come from the subsequent program cycle, except by approval in an advice letter process;

- Long-term obligations must be reported and tracked separately and include information regarding funds encumbered and estimated date of project completion; and
- Energy savings for projects with long lead times will be calculated by defining the baseline as the applicable codes and standards at the time of the issuance of the building permit.

14. For calculating the Performance Earnings Basis (PEB), funds encumbered for continuing programs or for programs with long lead times shall be counted when those funds are spent.
15. Mid-Cycle Funding Augmentations. See Rule IV.12 below.

III. Common Terms and Definitions

1. Common terms and definitions will facilitate the review, selection and evaluation of energy efficiency activities. In particular, program definitions should be designed to facilitate to the extent possible: (1) the identification of energy efficiency activities by end-use savings potential, (2) the evaluation, measurement and verification (EM&V) of those activities based on Commission-adopted EM&V protocols, and (3) the coordination of program development and evaluation with resource planning and procurement needs. To this end, Program Administrators and program implementers should use the definitions included in Appendix B to these Rules when characterizing any proposed program activity. The burden is on them to justify any departure from those terms and definitions.

IV. Cost-Effectiveness

1. The cost-effectiveness indicators referred to in these rules are described in the *California Standard Practices Manual: Economic Analysis of Demand-Side Management Programs* (SPM): Economic Analysis of Demand-Side Management Programs. Program Administrators and Implementers should perform cost-

effectiveness analyses consistent with the indicators and methodologies included in the SPM, unless otherwise indicated.[7]

2. This Commission relies on the Total Resource Cost Test (TRC) as the primary indicator of energy efficiency program cost effectiveness, consistent with our view that ratepayer-funded energy efficiency should focus on programs that serve as resource alternatives to supply-side options. The TRC measures the net resource benefits from the perspective of all ratepayers by combining the net benefits of the program to all ratepayers, both participants and non-participants. The benefits are the net present value of avoided costs of the supply-side resources avoided or deferred. The TRC costs encompass the net present value of the costs participants incur for the measures/equipment installed over the measure life and all non-rebate[8] costs incurred by the program administrator.[9] The TRC is calculated utilizing a discount rate that reflects each utility's weighted average cost of capital, as adopted by the Commission[10].

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7 See Appendix A of this manual for information on how to obtain a copy of the SPM and its clarifications.

8 The SPM restricts rebates to include only dollar benefits such as rebates or rate incentives (monthly bill credits) paid from the Program Administrator to participating ratepayers.

9 The TRC test uses the "incremental" measure cost (not the full cost) and incremental energy savings benefit (not the full energy savings benefit) when an energy-efficient appliance or measure promoted through the program is installed in lieu of the standard (less efficient) appliance/measure that would have been installed, without the utility EE activity. The TRC test uses the full measure cost (at the time of installation) and the full energy savings benefit (of the new measure) for the <u>remaining useful life</u> of the pre-existing equipment (e.g., 3 or more years), where the utility EE activity causes measure/equipment to be replaced much earlier. The TRC test then uses the incremental savings for the balance of the effective useful life of the newly installed measure/equipment and deducts the full cost of that equipment discounted back to the date of the measure/equipment installation.

10 For the 2006-8 program cycle an average IOU weighted cost of capital may have been used for cost effectiveness calculations. The value used for *ex ante* calculations should also be used for *ex post* calculations.

3. The Program Administrator Cost (PAC) test of cost-effectiveness should also be considered in evaluating program and portfolio cost-effectiveness. Under the PAC test, the program benefits are the same as the TRC test, but costs are defined differently to include the net present value of costs incurred by the program administrator (including financial incentives and rebates paid to anyone), but not the costs incurred by the participating customer. Like the TRC test, the PAC test is calculated utilizing a discount rate that reflects each utility's weighted cost of capital, as adopted by the Commission.

4. Applying both the TRC and PAC cost-effectiveness test is called the "Dual-Test". In almost all instances, an energy efficiency program that passes the TRC test will also pass the PAC test. However, if deployment of the program requires rebates or financial incentives to participants that exceed the measure cost, then the program may pass the TRC test, but fail the PAC test. Considering the results of both tests when evaluating program proposals ensures that program administrators and implementers do not spend more on financial incentives or rebates to participating customers than is necessary to achieve TRC net benefits.

5. TRC and PAC benefits should be computed utilizing the avoided cost methodologies and input assumptions, including non-price factors (e.g., for avoiding greenhouse gas and non-greenhouse gas pollutants) that have been developed for the evaluation of energy efficiency programs in our avoided cost rulemaking, R.04-04-025[11]. The performance earnings basis (PEB) of energy efficiency resource programs shall be calculated from TRC and PAC benefits (being equal) minus TRC and PAC costs weighted two-thirds and one-third respectively. (D.05-04-051).

6. A prospective showing of cost-effectiveness using the Dual-Test for the entire portfolio of ratepayer-funded energy efficiency activities and programs (i.e., individual programs, plus all costs not assignable to individual programs, such as overhead, planning, evaluation, measurement verification and administrator compensation and performance, if applicable) is a threshold condition for eligibility for ratepayer funds. This prospective showing of cost-effectiveness shall include the costs for shareholder incentives that are projected

[11] See D.05-04-024 and D.06-06-063.

to be paid for portfolio performance under the energy efficiency risk/reward incentive mechanism in effect at that time.[12] This threshold requirement applies to each of the following: (1) the entire statewide portfolio of programs and (2) the service-territory wide program portfolios offered by each Program Administrator, excluding emerging technologies programs. Program administrators must demonstrate that this threshold requirement is met on a prospective basis in their program funding applications to the Commission. If a prospective showing of cost-effectiveness for the entire statewide portfolio *including emerging technologies programs* does not also pass the Dual-Test, Program Administrators shall describe the benefits associated with these programs that are not reflected in the TRC or PAC tests, and describe how these programs are expected to produce benefits in excess of costs for California ratepayers over the long-term. Program Administrators must also demonstrate that the proposed level of electric and natural gas energy efficiency program activities are expected to meet or exceed the Commission-adopted electric and natural gas savings goals, by service territory.[13]

7. As described in these Rules, fuel-substitution programs must also pass the Dual-Test to be considered for inclusion in the portfolio and eligible for funding. In addition, as a condition for the inclusion of solar water heating within the definition of energy efficiency measures, solar water heating installations must be cost-effective on a stand-alone basis, i.e., pass the Dual-Test of cost-effectiveness to be eligible for funding. Similarly, solar-powered water circulators must be cost-effective on a stand-alone basis (i.e., pass the Dual-Test) to be eligible for funding.[14] Other programs are not strictly required to pass the Dual test on a program level basis to be considered for funding, but their cost-effectiveness must be carefully considered in order to design an overall portfolio that passes the Dual-Test, per Rule IV.6. Accordingly, except where otherwise indicated in these Rules, Program Administrators must present estimates of TRC and PAC net benefits for each program on a prospective basis in their program funding applications, along with any other information that may be requested by the Commission, Assigned Commissioner, Administrative Law Judge or Energy

[12] D.07-09-043, Mimeo page 220.

[13] Per D.04-09-060, savings from LIEE programs will also count towards these goals.

[14] Per D.07-11-004, eligible for 2006-2008 funding and cumulative savings goals.

Division.[15] However, evaluation, measurement and verification costs should not be allocated to individual programs in the calculation of TRC and PAC net benefits. Rather, all costs associated with evaluation, measurement and verification should be allocated at the total portfolio level, rather than program by program.

8. To support comparisons of all resources in the utilities' procurement portfolio, the program administrators are required to also provide levelized unit cost estimates at the portfolio, end-use and measure level consistent with the methods described in the SPM. This information should be submitted with the program administrators' compliance filings on the competitive bid results, during each program cycle.

9. The usefulness of the TRC test as a primary indicator of cost-effectiveness is limited for certain programs which do not necessarily focus on the timing or type of resource needs of the utility, such as programs designed to demonstrate or commercialize promising emerging energy efficiency technologies or structurally change the marketplace. For statewide marketing and outreach programs and information-only programs, the link between programs and savings is also difficult to discern. Therefore, the Commission and program administrators will need to consider factors and performance metrics other than the TRC and PAC Tests of cost-effectiveness when evaluating such program proposals for funding and when evaluating their results.

10. Fuel substitution programs may offer resource value and environmental benefits. Fuel-substitution programs should reduce the need for supply without degrading environmental quality. Fuel-substitution programs, whether applied to retrofit or new construction applications, must pass the following three-prong test to be considered further for funding:

1. The program must not increase source-BTU consumption. Proponents of fuel substitution programs should calculate the source-BTU impacts using the current CEC-established heat rate.

2. The program must have TRC and PAC benefit-cost ratio of 1.0 or greater. The TRC and PAC tests used for this purpose

[15] See, for example, Ordering Paragraph 4, D.04-09-060.

should be developed in a manner consistent with these Rules.

3. The program must not adversely impact the environment. To quantify this impact, respondents should compare the environmental costs with and without the program using the most recently adopted values for residual emissions in the avoided cost rulemaking, R.04-04-025. The burden of proof lies with the sponsoring party to show that the material environmental impacts have been adequately considered in the analysis.

For purposes of applying these tests, fuel substitution proponents must compare the technologies offered by their program with the most efficient same-fuel substitute technologies available to prospective participants that would have TRC and PAC benefit-cost ratio of 1.0 or greater. The burden of proof falls on the party sponsoring the analysis to show that the baseline comparison adheres to this requirement. Fuel substitution programs with a predominantly load building or load retention character are not eligible for funding, and the proponent of a fuel-substitution program carries the burden of proof to demonstrate that the program focuses on energy efficiency and creates net resource value.

11. To the extent possible, the assumptions that are used to estimate load impacts (e.g., kWh, kW and therm savings per unit, program net-to-gross ratios, incremental measure costs and useful lives) in the calculation of the TRC and PAC tests shall be taken from the most up-to-date version of the Database for Energy Efficiency Resources (DEER). [16] If the required cost-effectiveness test inputs for a measure to be included into a portfolio are not available in DEER, documentation supporting the inclusion of new information from alternate sources must be provided to Energy Division for review and approval prior to the inclusion of that measure's use in a savings claim or to a portfolio filing's approval. Cost-effectiveness parameters for non-DEER measures should be developed using methods and data from DEER to the extent possible. The evaluation, measurement and verification protocols for post-2005 programs will include a schedule and process for updating DEER on a regular basis. (See Rule V.2 below) (D.08-01-042)

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[16] See Appendix A of this manual for information on how to access DEER.

12. Costs and energy savings from mid-budget cycle funding additions for programs other than low income energy efficiency (LIEE) programs shall be counted when calculating portfolio cost-effectiveness and the performance earnings basis in applying the energy efficiency risk/return incentive mechanism. Energy savings from mid-budget cycle funding additions shall count towards the utilities' energy efficiency goals for resource planning purposes only. Such savings shall not be counted towards the energy efficiency goals for the purpose of 1) satisfying the minimum performance standard (MPS) associated with the energy efficiency risk/reward incentive mechanism, or 2) determining which "performance band" (e.g., deadband or applicable earnings tier level) should be used in calculating incentive payments or penalties. Each proposal to augment energy efficiency program funding must be carefully reviewed to ensure that such funding is not misclassified as LIEE, given the implications associated with LIEE classification that carry over to the adopted incentive mechanism. Savings associated with any mid-cycle funding augmentation to the LIEE program will not count towards the MPS. (OP 7, D.07-10-032)

V. Evaluation, Measurement and Verification (EM&V)

1. The development of energy efficiency programs that deliver reliable energy savings for California's ratepayers depends on well-designed methods of portfolio performance evaluation, measurement and verification (EM&V). Rigorous and strategically focused EM&V practices are required to gauge the performance of Program Administrators and Implementers, verify energy savings, improve the design and success of future energy efficiency programs and enhance the reliability of forecasted savings for resource planning purposes.

2. The performance basis and related EM&&V protocols for energy efficiency portfolios and programs for post-2005 energy efficiency activities were developed in the EM&&V phase of Rulemaking 01-08-028, and updated in Rulemaking 06-10-040, consistent with these Rules. The California Energy Efficiency Evaluation Protocols were initially adopted by ALJ Ruling dated April 25, 2006 (later updated in June 2006) to specify the current **minimum** acceptable approaches and procedures for the evaluation of utilities energy efficiency portfolios. Per D.05-01-055, Energy Division will have the lead role in the further development of EM&V protocols and procedures and the assigned ALJ may provide additional clarification and direction on EM&V administrative issues as needed.

3. In D.05-04-051 the Commission defined the current performance earnings basis, or PEB, as the net dollar benefits to ratepayers of the utilities portfolios calculated as specified in IV.5. above. In D. 07-09-043 the Commission defined the Minimum Performance Standard threshold, or MPS, for evaluation of the utility portfolios. Together the MPS and PEB form the "performance basis" focus for energy efficiency portfolio performance evaluation. Additionally, portfolio evaluation efforts are to be structured such that they can: 1) inform the program selection process, 2) provide early feedback to program implementers, 3) produce calculations of performance basis at the end of the funding period, and 4) feed back into the planning process for the next program cycle.

4. D.05-01-055 adopts an approach to EM&V administration whereby Energy Division has management and contracting responsibilities for all EM&V impact-related studies that will be used to 1) measure and verify energy and peak load savings; 2) generate data for savings estimates, cost-effectiveness inputs, and the Commission's adopted performance basis; and 3) evaluate whether portfolio goals are met.

5. As also directed in D.05-01-055, public participation in the development of impact-related evaluation studies will be provided in several stages including: 1) development of the EM&V protocols; 2) the overall EM&V plans, budget and the allocation of funding levels to studies will be addressed during each program planning cycle; 3) study results will be made available for public review and comment while in draft form; and 4) finalized studies will be made available for public review in an appropriate forum established by Assigned Commissioner's ruling.

6. D.05-01-055 adopts an approach to EM&V administration whereby Program Administrators and program implementers may directly contract for (and serve as technical lead in managing) program design evaluation and market assessment studies to assist them in selecting and managing a portfolio of programs to meet the Commission's objectives as well as provide them with access to information on a real-time basis to improve program delivery. While soliciting input from Energy Division, the Program Administrators should also take the lead in allocating Commission-authorized funding for this category of EM&V across individual studies, develop the scope of work for each study and prepare the RFPs. In their program plan applications, the Program Administrators should also describe each type of study (including general scope of work) they or their program implementers plan to manage and/or directly contract for in this category. All interested parties should have an opportunity to consider whether any of those proposed studies would create a conflict of

interest if the IOU Program Administrators or program implementers managed and directly contracted for them.

VI. Competitive Bidding and Partnership Programs

1. Competitive solicitations can help to identify innovative approaches or technologies for meeting savings goals with improved performance that might not otherwise be identified during the program planning process. However, not all program activities lend themselves to a competitive solicitation. It would be counterproductive to require open bids in instances where, for example, partnerships between IOUs and local governments ("local government partnership programs") can take advantage of the unique strengths that both partners bring to the table, or a combination of partnerships and bilateral contracting arrangements with private or public entities can deliver effective statewide initiatives, such as a statewide public awareness campaign or an upstream lighting program.

2. Competition in energy efficiency procurement should focus on soliciting good, new program ideas to achieve or exceed the Commission's savings goals, rather than allocating a specific percentage of program funding to particular implementers. Decisions on whether non-IOUs should be program implementers responsible for designing and delivering the program (rather than working to implement IOU-designed programs) should be made based on an evaluation of whether the program designs and delivery mechanisms proposed by non-IOUs are superior to those currently being implemented or planned for the future in achieving overall portfolio savings goals.

3. As directed in D.05-01-055, for each program planning cycle, the Program Administrators shall propose a portfolio of programs (with input from the Program Advisory Groups as described in that decision) that reflects the continuation of successful IOU and non-IOU implemented programs and new program initiatives designed to meet or exceed the Commission's savings goals with cost-effective energy efficiency. As part of that process, the Program Administrators will identify a minimum of 20% of funding for the entire portfolio of programs that will be put out to competitive bid to third-parties for the purpose of soliciting innovative ideas and proposals for improved portfolio performance. Per D.07-10-032, successful third-party programs from the 2006-2008 program cycle retained by the IOUs for successive budget cycles will count

towards the 20% and the extensions should be able to be structured as bilateral contracts. (D.07-10-032, OP 19) The portions to put out to bid could encompass programs currently designed and delivered by a combination of IOU and non-IOU program implementers. Any current program or group of programs (IOU or non-IOU designed and implemented) that can be improved upon in this way may be subject to open bids to replace, augment or otherwise enhance current efforts. However, open bids should not be required in instances where current or potential future partnerships between the Program Administrators and local governments can take advantage of the unique strengths that both partners bring to the table to deliver cost-effective energy efficiency services, or where combination of partnerships and bilateral contracting arrangements with private or public entities can deliver effective statewide initiatives that enhance portfolio performance. Such activities should be funded out of the 80% (maximum) core portfolio that is not put out to competitive bid.

4. As directed in D.05-01-055, the proposed portfolio of programs, portions to put out to bid and the bid evaluation criteria will be filed by the Program Administrators in their program plan applications for each funding cycle, and subject to Commission approval. Upon receiving Commission approval of the applications, the Program Administrators will complete the process of selecting programs and program implementers to design and deliver the programs in the next program cycle. During this process, the Program Administrators will develop and issue RFPs using criteria approved by the Commission and select a set of bids. For the 2007-2011 program cycle, third-party proposals will be included in the utility's portfolio application and the competitively bid RFP process and the PRG's review to ensure that the criteria are applied properly will occur prior to the utility's submittal of the application, as directed in D.07-10-032. The Peer Review Groups (including Energy Division's independent consultant(s)) will observe the Program Administrators' bid selection process to ensure that the criteria are applied properly. Before finalizing their selections, the Program Administrators will discuss the proposed results of their bid review process with the Peer Review Groups (and Energy Division's independent consultants). After incorporating feedback, the Program Administrators will make public all winning bids and submit compliance filings, as directed in D.05-01-055.

5. Future partnership programs need to be developed in a manner that places the Program Administrator and local government (or private) partner on more equal footing, in terms of involvement in program design and planning, information sharing and program implementation. We recognize that some program partners may prefer or be best suited to functioning as a subcontractor

to the Program Administrator and performing a supporting role for the program. However, this should not be the only option available for partnership programs. Other partnership arrangements, e.g., where the local government partner is fully involved in program planning and implementation, may take better advantage of the relative strengths of each partner. These arrangements must, in any event, be considered in light of other applicable Commission decisions, including the implementation of community choice aggregation , and should in no way diminish or dilute the responsibility and accountability of Program Administrators to meet the Commission-adopted savings goals.

6. Standard contract language should improve the effectiveness of future partnership programs. The standard language should establish the rights and responsibilities of the partners with sufficient flexibility to enable each partner to make improvements to program performance, as circumstances warrant. The standard language should also address information sharing, intellectual property ownership, reimbursement turn-around, dispute resolution, and other issues. Energy Division and Legal Division should work with the Program Administrators, interested local governments and other parties to develop a standard contract for future partnership programs, and submit that language with the program plans.

VII. Advisory Groups

Decision 07-10-032 eliminated the Public Advisory Groups (PAGs) for the purposes of planning for the 2009-11 program cycle and beyond. The following rules combine the functional descriptions of the PAGs with the Peer Review Groups (PRGs) for the 2006-2008 program cycle and the 2009-11 program cycle and beyond, and should be applied to the appropriate program cycle.

1. The Program Administrators should put together the advisory groups and implement the program design and selection process consistent with D.05-01-055 and D.07-10-032 and in the spirit of the collaborative approach they discuss in their filings. For 2009 and beyond, the Public Advisory Group (PAG) is eliminated while the Peer Review Group (PRG) is retained. Per Decision 07-10-032, the advisory function formerly performed by the PAG will be subsumed in the statewide strategic planning activity. These advisory groups should serve to: (1) promote transparency in the Program Administrator's decision-making process; (2) provide a forum to obtain valuable technical expertise from stakeholders and non-market participants; (3) encourage collaboration among stakeholders and (4) create an additional venue for public participation. The advisory groups will provide advice and feedback to the IOUs and provide

information to the Commission, but will not have any independent decision-making or contracting authority.

2. As discussed in D.05-01-055, members of the PAGs should be drawn from the energy efficiency expertise of both market and non-market participants across the full spectrum of program areas and strategies. One purpose of the PAGs is to provide guidance to the IOUs regarding region-specific customer and program needs, and provide a forum for input and collaboration with the local interests and stakeholders served by the programs. However, the PAGs must not focus exclusively on region-specific needs. The IOUs and their PAGs should also address statewide programs and consistency issues, bringing in national expertise as appropriate to consider these issues. For the purpose, the IOUs should form a subgroup of their PAG members who will closely collaborate and coordinate on statewide marketing and outreach, support for building codes and standards, education and training and other activities that secure both short- and long-term energy savings and peak demand reductions by providing a consistent and recognizable program presence throughout the state. In addition, the PAGs and IOUs should collaborate on statewide program designs and implementation strategies that increasingly integrate energy efficiency with demand response and distributed generation offerings to end-users. For 2009 and beyond, the Public Advisory Group (PAG) is eliminated while the Peer Review Group (PRG) is retained. Per Decision 07-10-032, the advisory function formerly performed by the PAG will be subsumed in the statewide strategic planning activity.

3. The IOUs and PAGs should ensure that statewide residential and nonresidential offerings take advantage of "best available practices" and avoid customer confusion by being as uniform and consistent as possible. While we recognize that differences in climate zones and other parameters may warrant some variations in program offerings to customers, these variations should be the exception and not the rule. If the need emerges to focus on a particular market segment, the IOUs and PAGs may also establish a separate working group of industry experts and stakeholders to address that need.

4. Energy Division and DRA staff will be *ex officio* members of each PAG and peer review subgroup described below, and CEC staff is invited to participate as *ex officio* members as well. The IOUs will select additional PAG members, but participation will be voluntary and there will be no formal voting rules or designation of voting or non-voting members. Within each PAG, the IOU will also identify and select a subgroup of non-financially interested members with extensive energy efficiency expertise that are willing to serve as

peer reviewers for the energy efficiency program evaluation and selection process, referred to as "Peer Review Groups" (PRGs.)

5. As described in D.05-01-055 and D.07-10-032, members of each PRG will be expected to: (1) oversee the development of criteria and selection of government partnership programs, (2) review the IOUs' submittals to the Commission and assess the IOUs' overall portfolio plans, their plans for bidding out pieces of the portfolio per the minimum bidding requirement and (3) review the bid evaluation utilized by the IOUs and their application of that criteria in selecting third-party programs. In addition, the three PRGs are expected to meet and assess the statewide portfolio in terms of its ability to meet or exceed short and long-term savings goals in compliance with these Rules.

6. The PAG meetings should be open to the public, and the IOUs should establish a clearinghouse website for noticing these meetings and posting documents to be discussed by the PAG at the meetings. In addition, the IOUs are expected to conduct public workshops, at least twice a year that are designed to solicit broad public input from non-PAG members concerning program design and implementation. For 2009 and beyond, the Public Advisory Group (PAG) is eliminated while the Peer Review Group (PRG) is retained. Per Decision 07-10-032, the advisory function formerly performed by the PAG will be subsumed in the statewide strategic planning activity.

VIII. Performance-Based Risk and Reward Incentive Mechanism

1. In accordance with Public Utilities Code Section 739.10, the Commission has established balancing accounts for each utility that remove significant regulatory disincentives for utility investments in energy efficiency and other demand-side management programs. With these balancing accounts, a large majority of the utilities' fixed-cost revenue requirements are no longer tied to the forecasted level of commodity electric and natural gas sales.

2. Per D.07-09-043 OP 2, as modified by D.08-01-042 OP 2, the risk/reward shareholder incentive mechanism applies to the energy efficiency programs funded for the 2006-2008 program cycle and for subsequent program cycles until further Commission notice. The risk/reward shareholder incentive mechanism is structured as follows:

a) To be eligible for earnings, SDG&E, PG&E and SCE shall meet the following minimum performance standard (MPS) for the energy efficiency portfolio as a whole, on an *ex ante* basis for load impacts, with verified installations and costs:

(1) Achieve a minimum of 85% of the Commission-adopted savings goals, based on a simple average of the percentage of each individual gigawatt-hour (GWh), megawatt (MW) and, as applicable, million therm (MTherm) goal they achieve, *and also*

(2) Meet a minimum of 80% of the goal for each individual savings metric.

b) SoCalGas shall meet the MPS and be eligible for earnings if it achieves a minimum of 80% of the MTherm savings goal on an *ex ante* basis for load impacts, with verified installations and costs.

c) Once the utility meets the MPS, earnings shall be calculated as a percentage (sharing rate) of the "performance earnings basis" (PEB) metric defined in Decision (D.) 94-10-059, as follows:

(1) Portfolio net benefits calculated using the Total Resource Cost test of cost-effectiveness are weighted by two-thirds, and

(2) Portfolio net benefits calculated using the Program Administrator Cost test of cost-effectiveness are weighted by one-third.

d) Program savings and costs shall be counted in determining whether the MPS is met and in calculating the PEB, as follows:

(1) Savings from low-income energy efficiency (LIEE) programs shall count towards determining whether the utilities have met their MPS, but neither LIEE program costs nor savings shall be included in the calculation of the PEB under the risk/reward shareholder incentive mechanism.

(2) With the exception of the Emerging Technologies Program and LIEE, all energy efficiency portfolio costs including associated evaluation, measurement and verification (EM&V) shall be included in the calculation of PEB.

(3) Verified savings from Codes and Standards Advocacy Programs[17] shall count as described in (a) and (b) below. Codes and Standards savings are to be *verified* (as opposed to *ex ante* estimates used for planning purposes).

(a) Fifty (50) percent of verified savings from pre-2006 Codes and Standards Advocacy Programs shall count towards the energy savings goals and minimum performance standards for the 2006-2008 (per D.07-09-043) and 2009-2011 (per D.07-10-032) program cycles.

(b One hundred (100) percent of verified savings from post-2005 Codes and Standards Advocacy Programs shall count towards the energy savings goals, minimum performance standards and performance earnings basis for the 2006-2008 and 2009-2011 program cycles.

Codes and Standards Advocacy costs are included as they are incurred in calculating the performance earnings basis and savings are included as they are realized.

e) If the utility has met the MPS, a first tier sharing rate of 9% shall apply. If the utility has met 100%

[17] D.05-09-043 and Attachment 10. ***Note*** – The 50% verified savings calculation for Codes and Standards Advocacy work applies only to savings leading to the adoption of the 2005 standards developed by the CEC. At the time, installed savings and committed savings had been counted during the same budget cycle. D. 05-04-051 had adopted a policy to count only verified savings. To avoid double counting of committed savings with verified savings, a methodology was developed and adopted to derive the amount of savings attributable to reducing energy over the future years concerned (post 2005) using a calculation considering economic potential, market potential and naturally-occurring savings associated with the codes adopted. The result was 50%.

of the savings goals, a second tier sharing rate of 12% shall apply, up to the earnings cap adopted for each utility.

(1) If the MPS is met, each individual savings metric must be no less than 5% below the second tier threshold to be considered within that tier based on the three-metric average.

(2) If the MPS is met utilizing *ex ante* assumptions for load impacts, with verified installations and costs, but the *ex post* EM&V results take an individual metric below the 80% threshold or take the overall portfolio results to between 65% and 85% of the Commission-adopted savings goals, the utility shall continue to earn at the first tier sharing rate of 9%, applied to the *ex post* PEB, and shall not return any interim claims payments. If, however, *ex post* results take a utility below 65% of Commission goals for any individual metric, the utility shall pay back any interim payments, in addition to any applicable penalty.

f) Penalties shall begin to accrue if portfolio performance for any single savings metric (GWh, MW or MTherm) falls to or below 65% of the savings goal for that metric. If this occurs, the larger of the following penalty provisions apply up to the penalty cap adopted for each utility:

(1) 5¢/kWh, 45¢/therm and $25/kW per unit penalties applied to each unit below the savings goal, or (if larger):

(2) Dollar-for-dollar payback of negative net benefits ("cost-effectiveness guarantee"), where negative net benefits are calculated based on the PEB formula adopted in D.04-10-059.

g) Total earnings and penalties are capped for the four utilities combined at $450 million over each three-year program cycle, beginning with the 2006-2008 program cycle. The $450 million combined cap is allocated to each utility as follows: PG&E--$180 million; SCE--$200 million; SDG&E-$50 million and SoCalGas--$20 million.

3. Earnings (or penalties) under the risk/reward shareholder incentive

mechanism shall be paid as follows:

a) There shall be two "progress payment" interim earnings claims and one final true-up claim for each three-year program cycle. They shall be linked to Energy Division's Verification and Performance Basis Reports as described in D.07-09-043 and in its Attachment 6.

b) Interim claims shall be evaluated on a "Cumulative-to-Date" basis, which counts the verified achievements from program year(s) in determining whether the MPS is met in each subsequent interim claim.

c) Thirty-five (35) percent of the earnings calculated for each interim claim shall be "held back" until the final true-up claim, in order to minimize the risk of overpaying earnings before the *ex post* true-up of load impacts in the final claim. (D.08-01-042)

d) The costs of shareholder incentives shall be included in calculations when (1) evaluating the cost-effectiveness of program plans submitted during the program planning cycle (on a projected basis), or (2) conducting a cost-effectiveness review of portfolio performance in hindsight. These costs shall not be included in the calculation of PEB.

See Appendix A for a graphic illustrating this mechanism.

4. Per D.08-01-042, for the 2006-2008 program cycle, the following *ex ante* assumptions of energy savings and demand reductions shall be used in conjunction with verified installations and verified costs to calculate the 1st and 2nd Claims:

(a) Except as otherwise provided for below, the *ex ante* measure savings parameters that are contained in the utilities' E3 calculators, as of the 4th quarter 2007 report for the 1st Claim and as of the 4th quarter 2008 report for the 2nd Claim.

(b) For measures contained in the Database for Energy Efficient Resources (DEER), the 2008 and 2009 DEER updates of *ex ante* measure savings parameters, including net-to-gross ratios and expected useful lives. The 2008 DEER update shall apply to the 1st Claim and the 2009 DEER update shall apply to the 2nd Claim.

(c) For customized measures or customized projects that represent aggregated measures in the E3 calculator, Energy Division shall identify the appropriate installed measure(s) based on its measure verification results and develop the associated *ex ante* load impact values. For this purpose, Energy Division may use the utilities' tracking system information, engineering workpapers, DEER values and methods, or other current measurement and verification results that are available.

5. Per D.08-01-042, direction on the *ex ante* assumptions used to calculate interim claims during the 2009-2011 program cycle shall be provided in the decision authorizing the 2009-2011 program plans.

6. Procedures for Review and Approval of Earnings/Penalties under the Energy Efficiency Risk/Reward Incentive Mechanism[18]. (D.07-09-043, OP 5, Attachment 7)

6a. <u>*Interim Claims*</u> - Payments under the interim claim(s) represent a "progress payment" towards total expected earnings:

(1.) Evaluation contractors use data requested from investor-owned utility (IOU) program tracking databases and reports to develop Contract Group[19] level reports that verify unit installations.

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[18] These procedures augment and substitute for Attachment 4 to *Administrative Law Judge's Ruling Adopting Protocols for Process and Review of Post-2005 Evaluation, Measurement and Verification Activities,* dated January 11, 2006.

[19] These procedures augment and substitute for Attachment 4 to *Administrative*

Footnote continued on next page

(2.) California Public Utility Commission (CPUC) audit team develops financial audit reports that verify portfolio costs for each utility.

(3.) Energy Division aggregates evaluation contractor reports and *ex ante* measure parameters (updated as directed in VIII.4 and VIII.5 above) for each utility to quantify the portfolio resource benefits and uses that quantity in connection with the audit team reports to develop the draft Verification Report, which is posted on a publicly accessible website. Energy Division notifies the CPUC Energy Efficiency service lists and lists of other interested stakeholders [20] maintained by Energy Division of the availability of the draft Verification Report and the website posting location. Energy Division also notifies all of those stakeholders of the conference described in the next Step.

(4.) Energy Division holds a conference by telephone or in person. At this meeting, all stakeholders have an opportunity to discuss the draft Verification Report with those who prepared it (and supporting consultants). Stakeholders may raise questions about the draft report, receive responses from those who prepared it, and point out any errors they believe are contained in the report. The goal is to have a give and take between the stakeholders, report authors, and the supporting technical experts.

(5.) Stakeholders have an opportunity to provide written comments to Energy Division identifying any errors in the draft Verification Report. Stakeholders will be required to include in the written comments at least a brief description of every point in the draft report which they believe needs correction, even if discussed at the conference.

Law Judge's Ruling Adopting Protocols for Process and Review of Post-2005 Evaluation, Measurement and Verification Activities, dated January 11, 2006.

[20] "Stakeholders" refers to those listed on one of the CPUC's Energy Efficiency service list or who have notified Energy Division of their interest.

(6.) Energy Division makes any necessary changes to the Verification Report stimulated by the oral conference and written comments. All written comments, and Energy Division's treatment of them, will be reflected in an appendix to the Final Verification Report, which is posted on a publicly accessible website.

(7.) Final Verification Report is made publicly available.

(8.) Within 45 days of issuance of the Final Verification Report, the utility will file an advice letter for Energy Division disposition pursuant to section 7.6.1 of General Order 96-B, citing the Verification Report. The advice letter will address whether based on that report there are any earnings or penalties, and if so at what level, for the interim claim.

(9.) Energy Division will approve the advice letter as soon as practicable thereafter so long as it correctly incorporates the results of the Verification Report; if it does not, Energy Division will take other appropriate action under General Order 96-B.

6b. _Final Claim_ - The final claim and true-up of savings and performance basis estimates will be based on the Final Performance Basis Report:

(1.)Evaluation contractors complete draft final evaluation reports[21] and post them on a publicly accessible website. The evaluation contractors will notify the CPUC Energy Efficiency service lists and lists of other interested stakeholders maintained by Energy Division of the availability of the draft final evaluation reports and their website posting location(s). Energy Division will notify all of those stakeholders of the conference described in the next Step.

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[21] Evaluation reports refer to either interim or final reports submitted to Energy Division by program evaluation contractors describing results of evaluations (e.g., impact evaluation studies) of the Contract Groups.

(2.) Evaluation contractors hold a conference, under Energy Division sponsorship, with stakeholders, by telephone or in-person, to discuss draft final evaluation reports.

(3.) Stakeholders have an opportunity to provide written comments identifying any errors in the draft final evaluation reports. Stakeholders will be required to include in the written comments at least a brief description of every point in the draft report which they believe needs correction, even if discussed at the conference.

(4.) Energy Division directs evaluation contractors to make any necessary changes to final evaluation reports stimulated by the comments. All written comments, and Energy Division's treatment of them, will be reflected in appendices to the final evaluation reports. The final evaluation reports are posted on a publicly accessible website.

(5.) Within 60 days of public release, program administrators will respond in writing to the final report findings and recommendations indicating what action, if any, will be taken as a result of study findings as they relate to potential changes to the programs. Energy Division can choose to extend the 60 day limit if the administrator presents a compelling case that more time is needed and the delay will not cause any problems in the implementation schedule, and may shorten the time on a case-by-case basis if necessary to avoid delays in the schedule.

(6.) Energy Division aggregates evaluation contractor reports for each utility to quantify the portfolio resource benefits and uses that quantity in connection with the audit team reports to develop the draft Final Performance Basis Report. Energy Division will notify the CPUC Energy Efficiency service lists and lists of other interested stakeholders maintained by Energy Division of the availability of the draft Final Performance Basis Report and the website posting location. Energy Division also notifies all of those stakeholders of the conference described in the next Step.

(7.) Energy Division, with the assistance of relevant contractors holds a conference with stakeholders, by telephone or in-person. At this meeting, all stakeholders have an opportunity to discuss the draft Final Performance Basis Report with those who prepared it (and supporting consultants). Stakeholders may raise questions about the draft report, receive responses from those who prepared it, and point out any errors they believe are contained in the report. The goal is to have a give and take between the stakeholders, report authors, and the supporting technical experts.

(8.) Stakeholders have an opportunity to provide written comments identifying any errors in the draft Final Performance Basis Report. Stakeholders will be required to include in the written comments at least a brief description of every point in the draft report or which they believe needs correction, even if discussed at the conference.

(9.) Energy Division makes any necessary changes to the Final Performance Basis Report stimulated by the oral conference and written comments. All written comments, and Energy Division's treatment of them, will be reflected in an appendix to the Final Performance Basis Report.

(10.) Final Performance Basis Report is made publicly available by posting on a publicly accessible website and sending it to the Energy Efficiency proceeding service list(s).

(11.) Within 60 days of issuance of the Final Performance Basis Report, the utility will file an advice letter for Energy Division disposition pursuant to section 7.6.1 of General Order 96b, citing the Final Performance Basis Report. The advice letter will address whether based on that report there are any earnings or penalties, and if so at what level, for the final claim.

(12.) Energy Division will approve the advice letter as practicable as possible thereafter so long as it correctly incorporates the results of the Final Performance Basis Report; if it does not, Energy Division will take other appropriate action under General Order 96-B.

IX. Affiliate and Disclosure Rules

1. To avoid anti-competitive behavior and cross-subsidies between IOUs and their affiliates, all transactions between the IOU administrator and any implementer that is an affiliate of PG&E, SCE, SDG&E or SoCalGas are banned, per D.05-01-055.

2. The Program Administrators will not provide preferential treatment to any provider of an energy efficiency service that uses energy efficiency program funds.

3. Bidders for EM&V contracts, including program design evaluation and market assessment studies, shall provide full disclosure of any potential conflicts of interest, including all current non-energy efficiency related contracts with Program Administrators and program implementers.

X. Reporting Requirements

1. The Program Administrators shall present information in their program planning applications in compliance with Ordering Paragraph 13 of D.04-12-048, and in compliance with any further direction by this Commission, the Assigned Commissioner or Administrative Law Judge regarding the content or format of these filings. Energy Division may develop reporting requirements through workshops or other means to ensure that the types of data and the format of the information presented in the Program Administrator filings and reports is as consistent as possible.

2. The Program Administrators shall file reports on portfolio and program activities on a regular basis during the program cycle using the standardized reporting formats, definitions, timelines and narratives established by the Energy Division, as updated from time to time. The design and oversight of program-specific, portfolio-level and financial reporting requirements for energy efficiency activities will remain the responsibility of the Energy Division, as discussed in D.05-01-055. Energy Division shall design the reporting requirements in consultation with the Assigned Commissioner and Administrative Law Judge.

3. In addition to other reports that may be required, the Program Administrators shall publish a summary of the achievements of the energy efficiency programs on an annual basis. This report will be available to the public on the web and will contain at least the following information for the entire portfolio as well as

each utility's portfolio: (1) energy savings (annual, cumulative, and lifecycle kWh and therms), peak demand savings[22], levelized costs, cost per kW saved, total cost to billpayers, total savings to billpayers, net benefits to billpayers and environmental benefits (tons of CO2 and other pollutants avoided). Following each program cycle, a summary of the *ex post* measured achievements from the entire portfolio will also be published.

4. The utilities shall incorporate the correction in the E3 calculator to the erroneous demand reduction estimated for lighting currently contained in DEER that is discussed in Section 8.3 of D.05-09-043. (D.05-09-043, OP 11.)

5. As discussed in D.05-09-043, the utilities are required to use the August 2005 updates to *ex ante* expected useful life (EUL) assumptions posted to DEER when reporting actual installations during program implementation, and when submitting calculations of savings, portfolio cost-effectiveness and performance basis during the 2006-2008 program cycle. Staff shall ensure that inputs to the E3 calculator are appropriately adjusted, so that these calculations will reflect the *ex ante* EUL values referenced above. (D.05-09-043, OP 12.)

XI. Process and Procedural Issues

1. The Commission, the assigned Commissioner, the assigned Administrative Law Judge, or the Energy Division may utilize both formal and informal procedural vehicles as needed to (1) revise the Rules and /or any of its referenced documents, in whole or in part, at any time, upon request by interested parties or on its own initiative, and (2) resolve disputes among or complaints from various market participants, as circumstances warrant. In addition, nothing in these Rules preclude the Commission from planning and developing future energy efficiency programs, or delegating that responsibility to the assigned Commissioner, the assigned Administrative Law Judge or to Energy Division in the future.

2. The Assigned Administrative Law Judge or Commission staff may hold workshops or other forums, as needed, for interested parties, customers and market actors to provide input and feedback on energy efficiency-related issues.

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[22] By D.06-06-063, the definition of peak megawatt load reduction contained in the 2005 Database for Energy Efficient Resources (DEER) shall be used for the purpose of verifying energy efficiency program and portfolio performance.

3. Any program proposal for energy efficiency funding must describe a dispute resolution process to be used in dealing with complaints from end-use gas or electric consumers participating or attempting to participate in the program. In programs where the Program Administrators hold contracts with third parties, those contracts will also be required to include dispute resolution provisions.

APPENDIX A: Reference Documents

1. **Energy Action Plan**

   http://www.cpuc.ca.gov/PUBLISHED/REPORT/51604.htm

1.a Energy Action Plan Update, February 2008:

http://www.cpuc.ca.gov/NR/rdonlyres/58ADCD6A-7FE6-4B32-8C70-7C85CB31EBE7/0/2008_EAP_UPDATE.PDF

2. **CPUC Decision 05-01-055 "Interim Opinion on the Administrative Structure for Energy Efficiency: Threshold Issues"**

   http://www.cpuc.ca.gov/PUBLISHED/FINAL_DECISION/43628.htm

3. **CPUC Decision 04-09-060 "Interim Opinion: Energy Savings Goals for Program Year 2006 and Beyond." See attached tables for the savings goals adopted in that decision, by IOU service territory.**

   http://www.cpuc.ca.gov/PUBLISHED/FINAL_DECISION/40212.htm

4. **Standard Practice Manual. Economic Analysis of Demand-Side Management Programs. October 2001.**

   ftp://ftp.cpuc.ca.gov/puc/energy/electric/energy+efficiency/em+and+v/std+practice+manual.doc

   - SPM 2001 Correction Memo. From D.07-09-043, Attachment 9, page 7 of 7 linked below for the "SPM Correction Memo of October 7, 1988"

   http://www.cpuc.ca.gov/NR/rdonlyres/3D41FF54-9809-4651-8898-78F93F84999B/0/CorrectionMemoSPM1071988.pdf

   - SPM 2007 Clarification Memo. From D.07-09-043, attached to this reference list.

   http://www.cpuc.ca.gov/NR/rdonlyres/A7C97EB0-48FA-4F05-9F3D-4934512FEDEA/0/2007SPMClarificationMemo.doc

   - **NTG Numerical Examples from D.07-09-043**

     http://www.cpuc.ca.gov/NR/rdonlyres/101F0713-7277-43A8-883D-8EF2712EFA8A/0/NumericalExamplesNTGAdjtoTRCD0709043.pdf

5. **Database for Energy Efficient Resources (DEER)** http://eega.cpuc.ca.gov/deer/

6. **Methodology and Forecast of Long Term Avoided Costs for the Evaluation of California Energy Efficiency Programs**

   http://www.ethree.com/CPUC/E3_Avoided_Costs_Final.pdf

   - **E3 Calculators (Updated to comply with D.07-09-043, 10-7-07)**

   http://www.ethree.com/cpuc_cee_tools.html

7. **CPUC Energy Efficiency Program Reporting Requirements Manual under the heading "Reporting Rules".**

   ftp://ftp.cpuc.ca.gov/PUC/energy/electric/energy+efficiency/programs/rrm4.pdf

8. **CPUC Energy Efficiency Program EM&V Protocols**

   ftp://ftp.cpuc.ca.gov/PUC/energy/electric/energy+efficiency/em+and+v/evaluatorsprotocols_final_adoptedviaruling_06-19-2006.doc

Energy Efficiency Programs

Approved Savings Goals 2006 through 2013 (D.04-09-060)

SCE

Year	Energy Savings Annual Goal (GWH/Yr)	Cumulative Energy Savings (GWH)**	Demand Reductions (MW/Yr)	Cumulative Demand Reductions (MW)**
2006	922	2574.9	207	541
2007	1046	3621.3	219	760
2008	1167	4788.5	246	1006
2009	1189	5977.2	249	1255
2010	1176	7153.4	247	1502
2011	1164	8317.1	245	1747
2012	1151	9468.5	241	1988
2013	1139	10607.6	240	**2228**

(1) Total Savings = all savings from energy efficiency programs funded by public goods charge and procureme
funding. This total includes savings from EE programs already in the CEC forecast. For incremental savings a
the levels included in the CEC forecast, see D.04-09-060 Attachment 9.
(2) GWh savings converted to MW by multiplying by .21, average of utility GWh to peak savings for 2004/5 applications. This is an estimate of average peak savings not coincident peak = GWH savings in peak period /
hours in period.

PG&E

Year	Gas Savings Annual Goal (MMTh/Yr)	Cumulative Gas Savings (MMTh)**	Energy Savings Annual Goal (GWH/Yr)	Cumulative Energy Savings (GWH)**	Demand Reductions (MW/Yr)	Cumulative Demand Reductions (MW)**
2006	12.6	32.1	829	2316.5	180	503
2007	14.9	47.0	944	3260.5	205	708
2008	17.4	64.4	1053	4313.5	228	936
2009	20.3	84.8	1067	5380.8	232	1168
2010	21.1	105.9	1015	6396.3	220	1388
2011	22	127.8	1086	7482.8	236	1624
2012	23	150.9	1173	8656.2	254	1878
2013	25.1	176.0	1277	9933.2	278	**2156**

(1) Total Annual Energy Savings = all savings from energy efficiency programs funded by public goods charge and procurement funding. This total includes savings from baseline EE program funding of $100 MM/yr accounted for in the CEC sales forecast. For incremental savings above the levels included in the CEC forecast, see D.04-09-060 Attachment 9.
(2) GWh savings converted to MW by multiplying by .217, which is ratio of GWh to peak savings for 2004/5 applications. This is an estimate of average peak savings not coincident peak = GWh savings in peak period / 560 hours in period.

Energy Efficiency Programs
Approved Savings Goals 2004 through 2013 (D.04-09-060)

SoCalGas

Year	Gas Savings Annual Goal (MMTh/Yr)	Cumulative Gas Savings (MMTh)**
2004	9.6	9.6
2005	9.6	19.3
2006	14.7	34.0
2007	19.3	53.3
2008	23.3	76.5
2009	27.2	103.7
2010	28.3	132.0
2011	29.9	161.9
2012	32.3	194.2
2013	35.8	230.1

Total Savings = all savings from energy efficiency programs funded by public goods charges and procurement funding.
This total includes natural gas savings from energy efficiency programs already included in the CEC forecast.

SDG&E

Year	Gas Savings Annual Goal (MMTh/Yr)	Cumulative Gas Savings (MMTh)**	Energy Savings Annual Goal (GWH/Yr)	Cumulative Energy Savings (GWH)**	Demand Reductions (MW/Yr)	Cumulative Demand Reductions (MW)**
2004	1.8	1.8	268.4	268.4		50.4
2005	1.8	3.6	268.4	536.8		100.7
2006	2.7	6.3	280.5	817.3	54.6	155.3
2007	3.1	9.5	285.1	1102.4	54.2	209.5
2008	3.7	13.1	284.4	1386.8	54	263.5
2009	4.1	17.3	282.3	1669.1	53.6	317.1
2010	4.5	21.8	273.6	1942.7	52	369.1
2011	4.9	26.7	262.5	2205.2	49.9	419
2012	5.3	32.0	221.7	2426.9	42.1	461.1
2013	5.7	37.6	214.9	2641.8	40.8	**501.9**

Total Savings = all savings from EE programs funded by public goods charge and procurement funding. This total includes savings from EE programs already in the CEC forecast. For incremental savings above the levels included in the CEC forecast, see D.04-09-060, Attachment 9)
MW Savings derived by multiplying GWh Savings by 0.19, average value SDG&E GWh to peak savings for 2004/5 applications. This is an estimate of average peak savings during all the peak hours: = GWh savings in peak period/560 hours in period.

Total Electricity and Natural Gas Program Savings Goals (all IOUs) 2006-2013 (D.04-09-060)

		Total Annual Electricity Savings (GWh/yr)	Total Cumulative Savings (GWh/yr)	Total Peak Savings (MW)	Total Annual Natural Gas Savings (MMTh/yr)	Total Cumulative Natural Gas Savings (MMTh/yr)
2004		1,838	1,838	379	21	21
2005		1,838	3,677	757	21	42
2006		2,032	5,709	1,199	30	72
2007		2,275	7,984	1,677	37	110
2008		2,505	10,489	2,205	44	154
2009		2,538	13,027	2,740	52	206
2010		2,465	15,492	3,259	54	260
2011		2,513	18,005	3,789	57	316
2012		2,547	20,552	4,328	61	377
2013		2,631	23,183	4,885	67	444

Total annual energy savings = all savings from EE programs funded by public goods charges and Procurement funding. This total includes savings from baseline EE program funding of $100 MM/yr accounted for in the CEC sales forecast. For incremental program savings above the levels included in the CEC forecast, see Attachment 9 of D.04-09-060.

Average peak MW estimated by multiplying GWh from utility by the ratio they used in 2004/5 filings ranging from 0.19 to 0.21. This is an estimate of average peak savings, not coincident peak savings = GWh savings in peak period/560 hours in period.

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D. 05-09-043

TABLE 8: ADOPTED FUND SHIFTING RULES, as modified by D.06-12-013 and D.07-10-032

Category	Shifts Among Budget Categories, Within Program	Shifts Among Programs, Within Category	Shifts Among Categories
Resource / Nonresource Programs (includes multiple program categories – see definitions below)	Yes, no formal Commission review/approval triggered.	• Yes, no formal Commission review/approval triggered. • However, 15 day PRG notification and comment required if shifts exceed 25% on an annual basis or 50% on a cumulative basis. • Adding a new program outside the competitive bid process triggers Advice letter process. • Advice letter required if allocation to third-party implementers is expected to fall below 20%.	• Yes, up to 25% on an annual basis or 50% on a cumulative basis. Advice letter required for larger shifts. • Adding a new program outside the competitive bid process triggers Advice letter process. • Advice letter required if allocation to third-party implementers is expected to fall below 20%.
C&S / ET / Statewide M&O	Yes, same as above	Advice letter required for shifts that would reduce any of these programs by more than 1% of budgeted levels.	Advice letter required to shift funds OUT of any program more than 1% of budgeted levels.
EM&V	Yes, within utility portion. Fund shifting between the utility and ED portions only with Assigned Commissioner or ALJ approval, in consultation with Joint Staff.	Not Applicable – Single Program	Assigned ALJ or Commissioner ruling required to shift funds OUT of EM&V by any amount.

For purpose of these fund-shifting rules, the Resource/Non-Resource program categories are as follows:

- Resource / Non-Resource Program categories for **SCE, SDG&E**, and **SoCalGas** are: (1) Residential; (2) Nonresidential; (3) Crosscutting (except C&S, ET, SW Marketing and Outreach, EM&V).
- Resource / Non-Resource Program categories for **PG&E** are: (1) Mass Market (residential/small commercial cross-cutting); (2) Residential targeted market sectors within Targeted Markets and (3) Non-Residential targeted market sectors within Targeted Markets.

Utility program administrators may carryover/carryback funding during the 2006-2008 program cycle without triggering a review/approval process. Authorization for utilizing 2006 funding in 2005 for specific purposes is described in D.05-09-043. Per D.06-12-013 (OP 2), utility program administrators may file an advice letter to seek authorization to shift existing, unspent uncommitted energy efficiency funds from previous program cycles to the 2006-2008 portfolio budgets to fund new energy efficiency programs or incremental energy efficiency activities as part of existing authorized programs. Utilities should consult with the PRG prior to submitting this type of advice letter. Per D.07-10-032, carryover/carryback funding is permitted during the 2006-2008 budget cycle so long as the 2009-2011 portfolio has been approved. CPUC approval is not necessary for up to 15% of the "current" program cycle. See Rules II.12 and II.13.

Changes to incentive levels or modifications to program design (such as changes to customer eligibility requirements) will not trigger Energy Division or formal Commission review, except as indicated below. We expect that the results of EM&V studies, statewide coordination efforts and ongoing consultation with advisory groups will enable utility program administrators to identify the best practices and program designs for portfolio implementation.

- If the proposed incentive level change impacts as statewide offering, e.g., is included in the deemed and calculated measure list presented in the statewide PAG meeting on August 2-3, 2005, and is less than 50% of the original incentive level on a cumulative basis over the three-year program cycle, the utility administrator will need to inform and solicit comment from the joint PRGs prior to the change taking place.
- If the proposed incentive level change impacts a statewide program offering and is more than 50% of the original incentive level on a cumulative basis, the utility administrator will follow the advice letter process described in these rules.
- The program administrator will notify the PRG of all incentive level changes that take place.

For all significant shifts in funding or modifications to program design, the utilities should seek informal review with their PRG members as part of the ongoing exchange of information during program implementation. Where an advice letter is required under these rules, absent a protest or written data request by Energy Division for additional information by the end of the 20-day protest period, the request will become effective on the twentieth day after filing. If Energy Division staff issues a data request before the end of the protest period, the response time requirements and other procedures applicable to our normal advice letter procedures, as updated by D.05-01-032, will take effect. All advice letters required for fund shifting shall be served on the service list in A.05-06-004 and R.01-08-028, or its successor rulemaking, unless otherwise specified by the assigned ALJ. The assigned ALJ, in consultation with the Assigned Commissioner, may provide further clarification on implementing these fundshifting rules, or consider modifications to these rules during the 2006-2008 program cycle, as appropriate.

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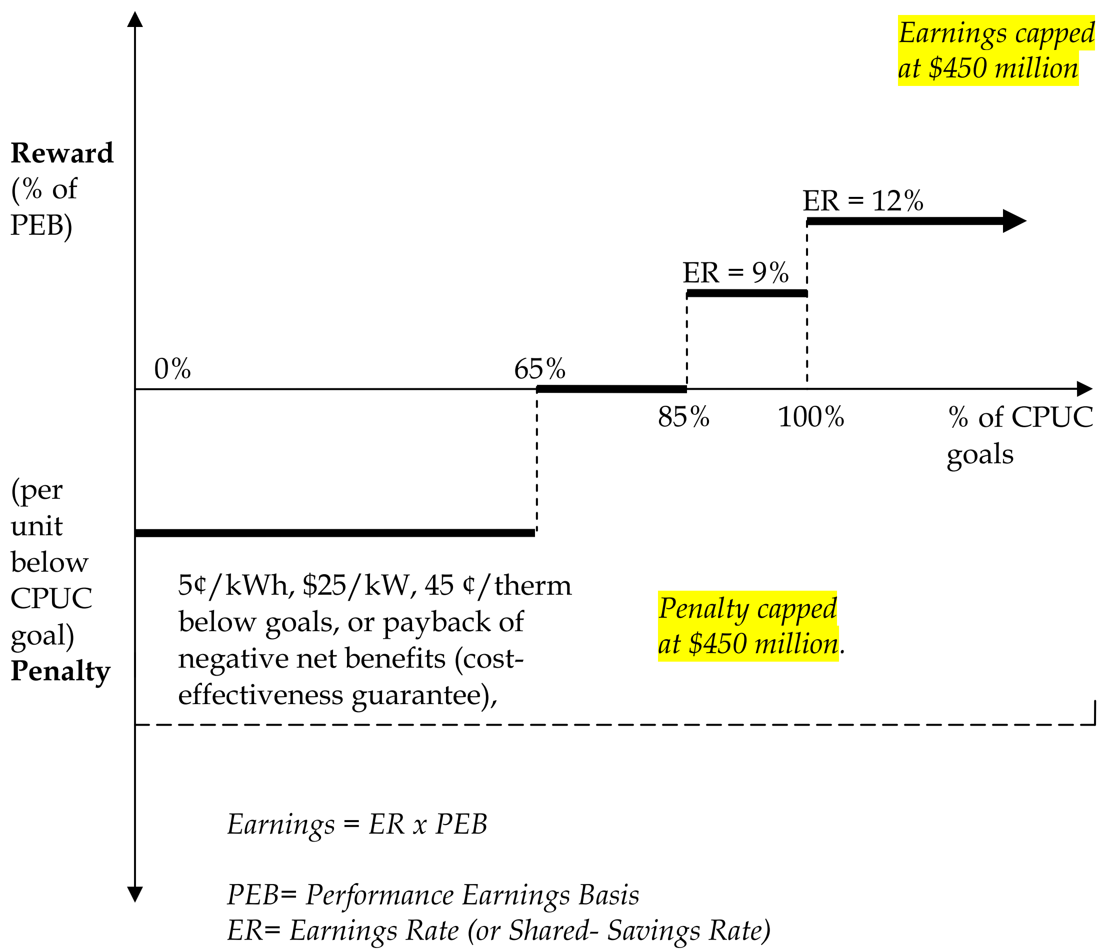
Figure 1: Adopted Incentive Mechanism Earnings/Penalty Curve



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APPENDIX B: GLOSSARY
COMMON ENERGY EFFICIENCY TERMS AND DEFINITIONS

Adopted Program Budget
The program budget as it is adopted by the Commission. Inclusive of costs (+/-) recovered from other sources.

Advanced Technologies
Measures or processes which exceed the efficiency or thermodynamic performance of standard energy using equipment or processes.

Affiliate
Any person, corporation, utility, partnership, or other entity 5% or more of whose outstanding securities are owned, controlled, or held with power to vote, directly or indirectly either by an administrator or any of its subsidiaries, or by that administrator's controlling corporation and/or any of its subsidiaries as well as any company in which the administrator, its controlling corporation, or any of the administrator's affiliates exert substantial control over the operation of the company and/or indirectly have substantial financial interests in the company exercised through means other than ownership. For purposes of these Rules, "substantial control" includes, but is not limited to, the possession, directly and indirectly and whether acting alone or in conjunction with others, of the authority to direct or cause the direction of the management of policies of a company. A direct or indirect voting interest of five percent (5%) or more by the administrator, its subsidiaries, or its affiliates in an entity's company creates a presumption of control.

Avoided Costs
Avoided costs refers to the incremental costs avoided by the investor-owned utility when it purchases power from qualifying facilities, implements demand-side management, such as energy efficiency or demand-response programs, or other wise defers or avoids generation from existing/new utility supply-side investments or energy purchases in the market. Avoided costs also encompass the deferral or avoidance of transmission and distribution-related costs. (D.08-01-006, Footnote 2)

Baseline Data
The initial base metric for comparing the net result of programmatic changes versus what would have happened in the absence of the program or activity.

Coincident Peak Demand
The metered or estimated demand of a device, circuit, or building that occurs at exactly the same time as the system peak for a given year and weather condition.

Community Choice Aggregators
Organizations created by local governments pursuant to Assembly Bill 117 for the purpose of procuring power and administering energy efficiency programs on behalf of local citizens.

Competitive solicitation
The process whereby parties are requested to submit bids offering innovative approaches to energy savings or improved program performance.

Conservation
Reduction of a customer's energy use achieved by relying on changes to the customer's behavior which may result in a lower level of end use service.

Conservation Measures
Activities and/or behaviors aimed at reducing energy consumption.

Conservation Programs
Programs which are intended to influence customer behavior as a means to reduce energy use.

Cost Effectiveness
An indicator of the relative performance or economic attractiveness of any energy efficiency investment or practice when compared to the costs of energy produced and delivered in the absence of such an investment.

Cream Skimming
Cream skimming results in the pursuit of a limited set of the most cost-effective measures, leaving behind other cost-effective opportunities. Cream skimming becomes a problem when lost opportunities are created in the process.

Cross Subsidization
Benefits enjoyed by one group, such as a customer class, which are funded by another group.

Customer
Any person or entity that pays an electric and/or gas bill to an IOU and that is the ultimate consumer of goods and services including energy efficiency products, services, or practices.

Cumulative Savings
As clarified in D.07-10-032, cumulative savings represent the savings in that year from all previous measure installations (and reflecting any persistence decay that has occurred since the measures were installed) plus the first-year savings of the measures installed in that program year.

Dual Test
The requirement that an energy efficiency activity pass both the TRC and the PAC cost-effectiveness test.

E3 Calculator
The E3 calculator is a model developed by Energy Environmental Economics (or "E3" for use by the utilities to map Commission-adopted avoided costs to energy efficiency programs for cost-effectiveness calculations.

Effective Useful Life (EUL)
An estimate of the median number of years that the measures installed under the program are still in place and operable.

Electricity Savings
Reduced electricity use (or savings) produced by either energy efficiency investments which maintain the same level of end use service or conservation actions which usually reduce energy use by reducing the quantity or quality of the baseline energy services demanded.

Emerging Technologies
New energy efficiency technologies, systems, or practices that have significant energy savings potential but have not yet achieved sufficient market share (for a variety of reasons) to be considered self sustaining or commercially viable. Emerging technologies include early prototypes of hardware, software, design tools or energy services that if implemented will result in energy savings.

Emissions Reductions
The Commission requires annual reporting of reduced emissions of carbon dioxide (CO2), sulfur oxides (SOx), nitrous oxides (NOx), and particulate matter (PM10) as a result of energy efficiency savings. The utilities use the E3 calculator to compute the

annual electric and natural gas emissions reductions, which are the units implemented in the year times the annual emission reduction for a particular measure. The E3 calculator calculates values of CO_2 in tons per kWh or therms; NOx and PM10 are in pounds per kWh or therms.

The following equations are from the "E3 Calculator Tech Memo" found at the following web link: http://www.ethree.com/CPUC/E3%20Calculator%20TechMemo%203c.doc

Emissions Reductions

Electric Reductions: CO2 tons per year *(Emission[E][CO2])*

$$Emission[E][CO2]_y = \sum_{Q=1+(y-1)*4}^{y*4} \left(IN_{M,Q} * kWh\_A_M * NTG_M * ER[CO2]_M \right)$$

Where

- y = year of consideration. 2006 = 1. "Total Annual" used for years 2008 through the end of the implementation period.
- Q = Quarter of the year. Jan-Mar 2006 = 1.
- $IN_{M,Q}$ = # of incremental of measures implemented in quarter *Q*.
- NTG_M = Net–to-Gross ratio for measure *M*.
- $ER[CO2]_M$ = Emission rate of CO2 in tons per kWh of measure *M*. (The emissions rate for each measure is calculated using the product of the hourly measure savings load shape and the hourly heat rate for the IOU.).
- kWh_A_M = Annual kWh reduction for measure *M*.

NOX and PM-10 equations are the same. Just replace [CO2] with the appropriate indicator. Note that CO2 emission rate is in tons per kWh. NOX and PM-10 are in pounds per kWh.

Gas Reductions: CO2 tons per year *(Emission[G][CO2])*

$$Emission[G][CO2]_y = \sum_{Q=1+(y-1)*4}^{y*4} \left(IN_{M,Q} * Th\_A_M * NTG_M * ER[CO2]_{GCT} \right)$$

Where

- y = year of consideration. 2006 = 1. "Total Annual" used for years 2008 through the end of the implementation period.
- Q = Quarter of the year. Jan-Mar 2006 = 1.
- $IN_{M,Q}$ = # of incremental of measures implemented in quarter *Q*.
- NTG_M = Net–to-Gross ratio for measure *M*.
- $ER[CO2]_{GCT}$ = Emission rate of CO2 in tons per therm, based on the gas combustion type (GCT) specified on the input sheet for the measure.

Th_A_M = Annual gas reduction (in therms) for measure *M*.

NOX and PM-10 equations are the same. Just replace [CO2] with the appropriate indicator. Note that CO2 emission rate is in tons per Therm. NOX and PM-10 are in pounds per Therm.

Energy Efficiency Groupware Application 2006 (EEGA2006)

The utilities post monthly and quarterly status reports to the EEGA2006 webpage, which is accessible to the public: **http://eega2006.cpuc.ca.gov.**

End Use

1) The purpose for which energy is used (e.g. heating, cooling, lighting).
2) A class of energy use that an energy efficiency program is concentrating efforts upon. Typically categorized by equipment purpose, equipment energy use intensity, and/or building type.

Energy Efficiency

Activities or programs that stimulate customers to reduce customer energy use by making investments in more efficient equipment or controls that reduce energy use while maintaining a comparable level of service as perceived by the customer.

Energy Efficiency Measure

An energy using appliance, equipment, control system, or practice whose installation or implementation results in reduced energy use (purchased from the distribution utility) while maintaining a comparable or higher level of energy service as perceived by the customer. In all cases energy efficiency measures decrease the amount of energy used to provide a specific service or to accomplish a specific amount of work (e.g., kWh per cubic foot of a refrigerator held at a specific temperature, therms per gallon of hot water at a specific temperature, etc). For the purpose of these Rules, solar water heating and stand-alone solar-powered water circulators are eligible energy efficiency measures. (Per D.07-11-004, OP 1.)

Energy Efficiency Programs

Programs that reduce customer energy use by promoting energy efficiency investments or the adoption of conservation practices or changes in operation which maintain or increase the level of energy services provided to the customer.

Energy Efficiency Savings

The level of reduced energy use (or savings) resulting from the installation of an energy efficiency measure or the adoption of an energy efficiency practice, subject to the condition that the level of service after the investment is made is comparable to the baseline level of service. The level of service may be expressed in such ways as the volume of a refrigerator, temperature levels, production output of a manufacturing facility, or lighting level per square foot.

Evaluation, Measurement and Verification (EM&V)
Activities which evaluate, monitor, measure and verify performance or other aspects of energy efficiency programs or their market environment.

Evaluation Project Budget
The project level evaluation budget as it is defined by the program administrators or Joint Staff for internal program budgeting and management purposes. Inclusive of direct and allocated overhead and costs (+/-) recovered from other sources.

Financial Incentive
Financial support (e.g., rebates, low interest loans, free technical advice) provided to customers as an attempt to motivate the customers to install energy efficient measures or undertake energy efficiency projects. (See Rebate)

Free Drivers
A free driver is a non-participant who adopted a particular efficiency measure or practice as a result of a utility program. (From April 2006 EM&V Protocols)

Free riders (Free Ridership)
Program participants who would have installed the program measure or equipment in the absence of the program.

Fuel Substitution
Programs which are intended to substitute energy using equipment of one energy source with a competing energy source (e.g. switch from electric resistance heating to gas furnaces).

Funding Cycle
Period of time for which funding of energy efficiency programs have been approved by the Commission.

Gas Savings
Reduced natural gas usage (or savings) produced by either energy efficiency investments which maintain the same level of end use service or conservation actions which can reduce energy use by reducing the quantity or quality of the baseline services provided.

Hard to Reach, Non Residential

Those customers who do not have easy access to program information or generally do not participate in energy efficiency programs due to a language, business size, geographic, or lease (split incentive) barrier. These barriers are defined as:

Language – Primary language spoken is other than English, and/or
Business Size – Less than ten employees and/or classified as Very Small, and/or
Geographic – Businesses in areas other than the San Francisco Bay Area, San Diego area, Los Angeles Basin or Sacramento, and/or
Lease – Investments in improvements to the building benefit the business only during the lease period; landlords benefit longer.

Hard to Reach, Residential

Those customers who do not have easy access to program information or generally do not participate in energy efficiency programs due to a language, income, housing type, geographic, or home ownership (split incentives) barrier. These barriers are defined as:

Language – Primary language spoken is other than English, and/or
Income – Those customers who fall into the moderate income level (income levels less than 400% of the federal poverty guidelines), and/or
Housing Type – Multi-family and Mobile Home Tenants, and/or
Geographic – Businesses in areas other than the San Francisco Bay Area, San Diego area, Los Angeles Basin or Sacramento, and/or
Home Ownership – Renters.

Incremental Measure Cost

The additional cost of purchasing and installing a more efficient measure. Calculated from the price differential between energy-efficient equipment and standard or baseline measures. The inclusion of the word "gross" in the definition reflects incremental measure costs, which have not been adjusted for free riders. Net incremental measure costs means that the term has been adjusted for free riders; i.e., the net-to-gross ratio has been applied.

Information & Education

Information and education programs can provide a wide range of activities designed to inform or educate a customer or customer group. Generally these range from in-depth, one-on-one, on-site or centrally located classroom style instruction in topics related to energy efficiency, to programs that target information to specific types of customers, to general information provided to a wide range of customers, to short inexpensive public service announcements on FCC approved communication frequencies. Programs intended to provide customers with information regarding generic (not customer-specific) conservation and energy efficiency opportunities. For these programs, the information may be unsolicited by the customer.

Innovation Incubator
A low-cost, stand-alone program designed to grow innovative energy saving programs and processes for the larger portfolio over the long term. The incubator funds new program ideas that meet reasonable scientific scrutiny for potentially cost-effective energy savings and peak reduction.

Institutional Barriers
A type of market barrier: In this case, the internal organizational hurdles that inhibit the evaluation and or choice to take energy efficiency actions.

Least Cost/Best Fit
The procurement of cost-effective supply and demand-side resources that, regardless of ownership, meet capacity and energy deliverability requirements. Energy efficiency resources are constructed from the bottoms up approach that aggregates the demand and energy savings from various energy-saving measures and activities into applicable end-use categories such as space cooling, space heating, lighting, and refrigeration, in order to provide near- and long-term peaking, intermediate, and baseload requirements.

Levelized Cost
An estimate of the annualized cost of installing an energy efficiency measures divided by the annual energy savings. Typically calculated by multiplying the incremental cost of the measure by capital recovery factor (function of discount rate and expected useful life of the measure) and then dividing by annual energy savings.

Load Management
Programs which reduce or shift electric peak demand away from periods of high cost electricity to non-peak or lower cost time periods, with a neutral effect on or negligible increase in electric use.

Load Serving Entities
Entities that provide electric and/or gas commodity to customers.

Lost Opportunities
Energy efficiency measures that offer long-lived, cost-effective savings that are fleeting in nature. A lost opportunity occurs when a customer does not install an energy

efficiency measure that is cost-effective at the time, but whose installation is unlikely to be cost-effective if the customer attempts to install the same measure later.

Market Effect
A market effect is a change in the structure or functioning of a market or the behavior of participants in a market that result from one or more program efforts. Typically these efforts are designed to increase in the adoption of energy-efficient products, services or practices and are causally related to market interventions. (From EM&V Protocols, April 2006).

Market Transformation
Decision (D.) 98-04-063, Appendix A, defines market transformation as "[l]ong-lasting, sustainable changes in the structure or functioning of a market achieved by reducing barriers to the adoption of energy efficiency measures to the point where further publicly-funded intervention is no longer appropriate in that specific market."

Marketing and Outreach
Communications activities designed to identify, reach and motivate potential customers to take actions to either learn more about or invest in energy efficiency opportunities.

Measures
1) Specific customer actions which reduce or otherwise modify energy end use patterns.
2) A product whose installation and operation at a customer's premises results in a reduction in the customer's on-site energy use, compared to what would have happened otherwise.

Minimum Performance Standard (MPS)
As part of the Shareholder Incentive Mechanism, the minimum performance standard is the minimum level of savings that utilities must achieve relative to their savings goal before accruing earnings and is expressed as a percentage of the Commission-adopted savings goals per utility. The utility MPS is based on the whole energy efficiency portfolio and the minimum goal of each individual savings metric. (See Rule VIII.)

Net to Gross Ratio
A ratio or percentage of net program impacts divided by gross or total impacts. Net to gross ratios are used to estimate and describe the free-ridership that may be occurring within energy efficiency programs.

Non-price Factors
Those factors included in cost effectiveness tests, other than commodity prices and transportation and distribution costs, e.g., environmental factors.

Operating Program Budget
The program budget as it is defined by the program administrators for internal program budgeting and management purposes. Inclusive of costs (+/-) recovered from other sources.

Participant Test
The Participant Test is the measure of the quantifiable benefits and costs to the customer due to participation in a program. Since many customers do not base their decision to participate in a program entirely on quantifiable variables, this test cannot be a complete measure of the benefits and costs of a program to a customer. (See SPM link under Attachment A.)

Partnership
Coordinated efforts of a utility and a local government or other entity to use the strengths of both parties to achieve energy savings goals.

Peak Demand (per OP 1 of D.06-06-063)
The average grid level impact for a measure between 2 p.m. and 5 p.m. during the three consecutive weekday period containing the weekday temperature with the hottest temperature of the year.

Peak Demand-General (kW)
1) The maximum level of metered demand during a specified period, such as a billing month, or during a specified peak demand period.
2) Extremely high energy use, usually with reference to a particular time period.

Peak Savings- Coincident (kW)
The estimated peak (e.g. highest) demand savings (MW or kW) from a program for a specific time, date, and location coincident with the forecasted system peak for a given area and a given set of weather conditions. This estimate must also include consideration of the likelihood that the equipment is actually on at the time of coincident peak. Usage of this definition: Resource planning- for making adjustments to forecasts of peak usage for understanding reserve margins and reliability purposes.

Peak Savings- Daily Average (kW)
The average peak demand savings (kWh impacts/ # of hours in the peak rate period) for a given utility during their peak season. Example for SCE-Peak period is for summer

weekdays from 12-6 PM. So - daily average savings would be the number of kWh saved/ # of kWhs saved for all weekday peak periods (= kWh/5 days/week * 12 weeks/ summer* 6 hours/day = kW average. Usage: Cost effectiveness analysis, primarily for valuing energy savings that occur during the peak period using "peak" average avoided costs.

Peak Savings –Non coincident (kW)

Estimated highest level of peak savings(kW or MW) for a given program during the peak time period for a given utility on the hottest day of a "normal" weather year. Thus if a group of measures saved 1MW at 2Pm, 1.7 MW at 3PM, 1.6 MW at 4PM, 1.0 MW at 5Pm and 1.2 MW at 6 pm, the peak non coincident savings would be 1.7 MW. This savings estimate does not take into account how many of the affected devices or equipment will be operating during the peak time period. Usage: Cost effectiveness analysis and procurement.

Peer Review Group (PRG)

A subset of the Program Advisory Group consisting of non-financially interested members who will review utility submittals to the Commission, assess overall portfolio plans, plans for bidding out pieces of the portfolio, and the bid evaluation criteria for selecting third-party programs.

Performance Basis

The metrics by which a program or a group of programs is measured and evaluated for the purpose of assessing the program(s) success at displacing or deferring more costly supply-side resources and or increasing more energy efficient design and practices.

Performance Earnings Basis (PEB)

A metric used in the shareholder incentive mechanism consisting of total portfolio net benefits (TRC) weighted 2/3rd and total Program Administrator Cost (PAC) portfolio net benefits weighted 1/3rd. (See Rule VIII.)

Performance Uncertainties

A market barrier: refers to new technologies or systems whose efficiency or system performance levels are uncertain due to lack of experience.

Portfolio

All IOU and non-IOU energy efficiency programs funded by ratepayers that are implemented during a program year or cycle. May also refer to a group of programs sponsored, managed, and contracted for by a particular IOU.

Portfolio Reporting
Regularly scheduled reporting by the portfolio administrators directly to the CPUC. Metrics reported are: portfolio budgets and expenditures, measures installed, services rendered, and other program activity deemed relevant to Energy Division's responsibility to support the Commission's responsibilities of quality assurance, policy oversight, and EM&V.

Pre-commercialization
A phase in the life of a product before it is readily available on the market.

Program
A collection of defined activities and measures that

- are carried out by the administrator and/or their subcontractors and implementers,
- target a specific market segment, customer class, a defined end use, or a defined set of market actors (e.g. designers, architects, homeowners),
- are designed to achieve specific efficiency related changes in behavior, investment practices or maintenance practice in the energy market,
- and are guided by a specific budget and implementation plan.

Program Activities
Any action taken by the program administrator or program implementer in the course of implementing the program.

Program Administrator
An entity tasked with the functions of portfolio management of energy efficiency programs and program choice.

Program Administrator Cost (PAC) Test
Under portfolio evaluation of cost effectiveness, the PAC test contains the program benefits of the TRC test, but costs are defined differently to include the costs incurred by the program administrator but not the costs incurred by the participating customer. (See the SPM link under Attachment A.)

Program Advisory Group (PAG)
Advisory groups for each utility service area composed of energy efficiency experts representing customer groups, academic organizations, environmental organizations, agency staff and trade allies in the energy market. For 2007 and beyond, the Public Advisory Group (PAG) is eliminated while the Peer Review Group (PRG) is retained. Per Decision 07-10-032, the advisory function formerly performed by the PAG will be subsumed in the statewide strategic planning activity.

Program Cycle
The period of time over which a program is funded and implemented.

Program Implementation Plan
A detailed description of a program that includes program theory, planned program processes, expected program activities, program budget, projected energy savings and demand reduction and other program plan details as required by the Commission, assigned ALJ, or Energy Division.

Program Implementers
An entity or person that puts a program or part of a program into practice based on contacts or agreements with the portfolio manager.

Program Strategy
The set of activities deployed by the program in order to achieve the program's objectives.

Program Year(s)
The calendar year(s) during which the program operates.

Ratepayer
Those customers who pay for gas or electric service under regulated rates and conditions of service.

Rebate
A financial incentive paid to the customer in order to obtain a specific act, typically the installation of energy efficiency equipment.

Report Month
The month for which a particular monthly report is providing data and information. For example, the report month for a report covering the month of July 2006, but prepared and delivered later than July 2006, would be July 2006.

Resource Value
An estimate of the net value of reliable energy (e.g., kWh, therms) and capacity (e.g., kW, Mcfd) reductions resulting from an energy efficiency program. This includes the

net present value of all of the costs associated with a program and all of the estimated benefits (both energy and capacity). The calculation of resource value and associated benefits should be consistent with the avoided costs adopted in the most recent Commission proceeding or otherwise provided for by the Commission.

Service Area
The geographical area served by a utility.

Short Term/Long Term
Planning terms referring to the timing or expected timing of program activities, program impacts, or program funding. Short term indicates program activities, program impacts, or program funding that occurs during the current program cycle. Long term indicates program activities, program impacts, or program funding that occurs beyond the current program cycle.

Source-BTU Consumption
Conversion of retail energy forms (kWh, therms) into the BTU required to generate and deliver the energy to the site. This conversion is used to compare the relative impacts of switching between fuel sources at the source or BTU level for the three-prong test required for fuel-substitution programs.

Spillover
Reductions in energy consumption and/or demand in a utility's service area caused by the presence of the DSM program, beyond program related gross or net savings of participants. These effects could result from: (a) additional energy efficiency actions that program participants take outside the program as a result of having participated; (b) changes in the array of energy-using equipment that manufacturers, dealers and contractors offer all customers as a result of program availability; and (c) changes in the energy use of non-participants as a result of utility programs, whether direct (*e.g.*, utility program advertising) or indirect (*e.g.*, stocking practices such as (b) above or changes in consumer buying habits)." **Participant spillover** is described by (a), and **non-participant spillover**, by (b) and (c). **Some parties refer to non-participant spillover as "free-drivers."** (From EM&V Protocols, April 2006)

Standard Practice Manual (SPM)
The California Standard Practice Manual: Economic Analysis of Demand-side Programs and Projects is jointly issued by the California Public Utilities Commission and the California Energy Commission. It defines the standard cost effectiveness tests and their components used for energy efficiency programs.

Statewide

Energy efficiency programs or activities that are essentially similar in design and available in all Commission regulated utility service areas in California.

Third Party/Non-IOU

Non-regulated implementers of ratepayer funded energy efficiency activities.

Total Resource Cost Test (TRC)

The TRC test measures the net resource benefits from the perspective of all ratepayers by combining the net benefits of the program to participants and non-participants. The benefits are the avoided costs of the supply-side resources avoided or deferred. The TRC costs encompass the cost of the measures/equipment installed and the costs incurred by the program administrator. (See SPM link under Attachment A.)

Zero Net Energy

Zero Net Energy is defined as the implementation of a combination of building energy efficiency design features and on-site clean distributed generation that result in no net purchases from the electricity or gas grid, at the level of a single "project" seeking development entitlements and building code permits. Definition of zero net energy at this scale enables a wider range of technologies to be considered and deployed, including district heating and cooling systems and/or small-scale renewable energy projects that serve more than one home or business. (D.07-10-032, Footnote 42.)

(END OF APPENDIX B)

Attachment 199.1

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June 10, 2011
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ELECTRONIC FILING

British Columbia Utilities Commission
6th floor, 900 Howe Street
Vancouver, BC V6Z 2N3

Attention: Ms. Alanna Gillis
Acting Commission Secretary

Dear Sirs/Mesdames:

Re: FortisBC Energy Inc. and Fortis Energy (Vancouver Island) Inc.
(the "FortisBC Energy Utilities")
Energy Efficiency and Conservation Program Natural Gas Vehicles Incentive

We enclose for filing in the above proceeding the electronic version of the Submissions on behalf of FortisBC Energy Utilities on Exhibit A-6.

Twelve hard copies of the Submissions on Exhibit A-6 will follow by courier.

Yours truly,

FASKEN MARTINEAU DuMOULIN LLP

[original signed by Matthew Ghikas]

Matthew Ghikas

MTG/fxm
Enc

BRITISH COLUMBIA UTILITIES COMMISSION

IN THE MATTER OF the *Utilities Commission Act,*

R.S.B.C. 1996, Chapter 473 (the "*Act*")

and

FortisBC Energy Inc. and

FortisBC Energy (Vancouver Island) Inc.

(the "FortisBC Energy Utilities")

ENERGY EFFICIENCY AND CONSERVATION PROGRAM

NATURAL GAS VEHICLE INCENTIVES

Submission of the FortisBC Energy Utilities on Exhibit A-6

June 10, 2011

Table of Contents

A. INTRODUCTION

1. This is the submission of FortisBC Energy Utilities (the "FEU") with respect to Exhibit A-6, in which the Commission requested submissions on the following:

> The ability and appropriateness of the utility moving EEC funds among programs that meet the definition of "demand-side measure" in the Utilities Commission Act and programs that do not.

2. In the context of this regulatory process regarding the use of incentive funding for Natural Gas Vehicles in the Commercial NGV Demonstration Program (the "NGV Program"), the implication of the statement above is that the NGV Program may not be a "demand-side measure". In this submission, FEU will first explain why the NGV Program is a demand-side measure within the meaning of the *Utilities Commission Act* ("UCA") and, second, will explain why the expenditures are recoverable as prudent expenditures regardless.

B. THE NGV INNOVATIVE TECHNOLOGIES PROGRAM IS A "DEMAND-SIDE MEASURE"

3. The FEU submit that the NGV Program meets the definition of "demand-side measure" in the UCA. The definition of "demand-side measure" in the UCA refers to the *Clean Energy Act* where the term is defined as follows:

> "Demand-side measure" means a rate, measure, action or program undertaken
>
> (a) to conserve energy or promote energy efficiency,
>
> (b) to reduce the energy demand a public utility must serve, or
>
> (c) to shift the use of energy to periods of lower demand,
>
> but does not include
>
> (d) a rate, measure, action or program the main purpose of which is to encourage a switch from the use of one kind of energy to another such that the switch would increase greenhouse gas emissions in British Columbia, or
>
> (e) any rate, measure, action or program prescribed;

4. The NGV Program is undertaken to promote energy efficiency and thus falls into paragraph (a) of the above definition. The fact that the FEU's innovative technology programs "promote energy efficiency" is reflected in the scope of the Innovative Technologies Program Area itself, as defined in the 2008 Energy Efficiency and Conservation ("EEC") Application, which states:[1]

> It should be noted that the initiatives listed in this Section do not include all the innovative technologies that the Companies may pursue, but rather provide an overview of the types of initiatives the Terasen Utilities intend to pursue, <u>all having the same underlying characteristics</u>:
>
> <u>1) Each promotes the efficient use of natural gas through sustainable design</u>
>
> 2) None are currently a mainstream technology
>
> 3) Each offers the potential for at least a 10% GHG benefit.
>
> <u>For all sectors, programs for fuel-substitution include plans that displace less efficient and dirtier fuels with natural gas or add cleaner renewable fuels to natural gas for further efficiency and GHG benefits</u>. [Emphasis added.]

5. Notably, paragraph (a) of the definition of "demand-side measure" includes programs that "conserve energy" or "promote energy efficiency." Meaning must be ascribed to the words in the legislation so that the words are not redundant or meaningless. "Promoting energy efficiency" must therefore be given a meaning that is different than "conserve energy". One important way of understanding energy efficiency beyond conserving energy is through the concept of the use of the right fuel for the right activity. Using the right fuel for the right activity can be a more efficient or effective use of energy from a variety of perspectives, such as in a system utilization sense, an economic sense, or an environmental sense such as promoting greenhouse gas ("GHG") reduction. The NGV Program promotes energy efficiency in all these ways.

6. The NGV Program is energy efficient from the perspective of the use of energy resources and delivery systems in the province. Without incentives for natural gas vehicles ("NGV"), customers would not purchase NGVs, and NGV load on the natural gas system would

[1] Exhibit B-3, CEC IR 1.1.3.

not occur; the transportation energy demands of these customers would have been met with diesel fuel. As the NGV demand is a relatively flat year-round load, it increases natural gas use in the lower demand summer period, resulting in an increased load factor and more efficient use of the natural gas delivery system overall.[2] The NGV Program thus accomplishes the objective identified in paragraph (c) of the definition of "demand-side measure": "to shift the use of energy to periods of lower demand." From the perspective of fleet owners, the use of natural gas is also more energy efficient in an economic sense.[3] In addition, the NGV Program promotes switching from high GHG-emitting forms of energy to natural gas as a transportation fuel.[4] This is more efficient as it results in the energy demand being met with less resulting GHG emissions. This objective is supported by British Columbia's energy objectives set out in section 2 of the *Clean Energy Act*.

7. The FEU's interpretation is supported by the Province's 2007 Energy Plan, which states on page 21:

> <u>Promote Energy Efficiency</u> and Alternative Energy
>
> <u>It is important for British Columbians to understand the appropriate uses of different forms of energy and utilize the right fuel, for the right activity at the right time. There is the potential to promote energy efficiency and alternative energy supplemented by natural gas.</u> Combinations of alternative energy sources with natural gas include solar thermal and geothermal. Working with municipalities, utilities and other stakeholders the provincial government <u>will promote energy efficiency</u> and alternative energy systems, such as solar thermal and geothermal throughout the province. [Emphasis added.]

8. Although not referring to NGV per se, the quote above demonstrates that promoting the switching to a lower GHG emitting source of energy is a way to promote energy efficiency. The users of energy in these situations may not be using *less* energy, but they are using energy more *efficiently* by using "the right fuel, for the right activity at the right time."

---

[2] Since NGV load has a flat year-round profile and FEU's core load is heavily weighted towards winter space heating use, adding NGV load will increase the summer throughput as a percentage of the annual throughput. When this is coupled with the fact that winter-weighted core throughput is declining due to the impacts of FEU's EEC programs and other drivers of declining gas use, the impact of adding NGV load on system efficiency and load factors is magnified. (Exhibit B-1, BCUC IR 1.7.3, 1.7.4 and 1.2.2.1.)

[3] Exhibit B-1, BCUC IR 1.7.4.

[4] Exhibit B-1, BCUC IR 1.7.4.

9. The FEU have been clear with respect to the scope of their EEC activities. In the Terasen Utilities May 2008 Energy Efficiency and Conservation Application, the introduction states:[5]

> EEC Activity is a term that describes what has been referred to in previous Regulatory filings as Demand Side Management ("DSM") activity. "EEC" and "DSM" are used interchangeably throughout this document; both terms refer to activities undertaken by the Companies that have the goal of affecting customers' use of natural gas, <u>either through conservation activity or through load-building/fuel switching activity</u>. [Emphasis added.]

10. Load building and fuel switching activities are a recognized form of demand-side management in the industry.[6]

11. Fuel switching programs may be "demand-side measures" within the meaning of the definition in the *Clean Energy Act*. Paragraph (d) of the definition of "demand-side measure" states that the definition excludes programs which encourage a switch from one kind of energy to another such that the switch would *increase* GHG emissions in B.C. The definition thus contemplates that programs that encourage a switch that would *decrease* GHG emissions in the Province may be demand-side measures. The NGV Program is just such a program, as it adds load by encouraging the switch from other forms of energy, such as diesel, to natural gas, which reduces GHG emissions.

12. Moreover, the Commission has previously accepted other EEC expenditures directed at fuel switching from fossil fuels with higher carbon content than that of natural gas.[7] The FEU currently provide incentives for customers to install Energy Star and EnerChoice equipment and appliances where customers wish to switch to natural gas as the fuel of choice. On Vancouver Island, for example, there is a program to encourage switching from the use of oil to natural gas for home heating.[8] Similar to the NGV Program, these programs add load to

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[5] Exhibit B-1, BCUC IR 1.7.3.

[6] Terasen Utilities May 2008 Energy Efficiency and Conservation Application, Appendix 12, *California Standard Practice Manual DSM-7-02,* pages 2-4.

[7] In the Matter of Terasen Gas Inc. Terasen Gas (Vancouver Island) Inc. Energy Efficiency and Conservation Application, Decision, dated April 16, 2009, at page 18.

[8] Ibid.

the system, reducing GHG emissions and resulting in a greater utilization of the distribution infrastructure.

13. The FEU therefore submit that the NGV Program is a “demand-side measure” within the meaning of the UCA and is similar to other EEC programs.

C. IMPLICATIONS IF NGV PROGRAM IS NOT A DEMAND-SIDE MEASURE

14. The FEU have made detailed submissions regarding the ability of the FEU to move EEC funds amongst program areas within the Commission-accepted EEC funding envelope.[9] The Commission’s acceptance of the EEC funding envelope was made pursuant to section 44.2(a) of the UCA which applies to “demand-side measures”. If the FEU were to expend funds in a program that was not a “demand-side measure,” as defined in the *Clean Energy Act,* this would mean that the FEU did not have a prior public interest approval pursuant to section 44.2 for the expenditure of those funds. However, this does not mean that it was inappropriate for the FEU to expend those funds.

15. The FEU have addressed the implications for FEU of a Commission determination that FEU does not yet have section 44.2 approval for the NGV Program expenditures.[10] Those submissions are equally applicable if the NGV Program was not a “demand-side measure.” As FEU have submitted, section 44.2 acceptance is optional and the UCA does not prohibit the FEU from engaging in EEC activities without prior approval from the Commission. In the absence of a section 44.2 public interest determination, the Commission must assess the forecast amortization expenses relating to past NGV Program expenditures when setting rates for the FEU. In fact, the NGV Program amortization expenses are currently included in the FEU’s Revenue Requirements Application before the Commission, and the FEU are seeking that these costs be recovered in rates.

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[9] FEU Final Submissions, Part Two.

[10] FEU Final Submissions, Part Two (pp. 16-17).

16. The NGV Program has many benefits to customers, including keeping natural gas delivery rates low for the benefit of all users.[11] As explained in Part Three and Four of its Final Submissions, the FEU submit that the NGV Program expenditures are in the public interest, were prudently incurred, and should therefore be approved. These submissions apply whether or not the expenditures meet the definition of "demand-side measure."

D. CONCLUSION

17. The benefits of including NGV Program funding within the overall EEC portfolio are well-established, and the rationale for stakeholders - including customers and Government - supporting those initiatives is clear. The NGV Program initiatives pursued to date are among the strongest initiatives in the overall portfolio when assessed according to the Commission-approved Total Resource Cost ("TRC") test, and high-to-low carbon fuel switching has environmental and other benefits. The NGV Program promotes energy efficiency, adding relatively flat NGV load which results in a more efficient use of the natural gas delivery system and lower GHG emissions in the Province. The FEU respectfully submit the Commission should therefore conclude that the NGV Program is a demand-side measure within the meaning of the *UCA* and the *Clean Energy Act* and that the FEU are able to apply EEC funding to the NGV Program within the Commission-approved EEC expenditure schedule. In the alternative, the FEU submit that the Commission should nonetheless conclude the expenditures on the NGV Program were prudent and in the public interest and therefore eligible for recovery from ratepayers in rates to be set for the FEU.

ALL OF WHICH IS RESPECTFULLY SUBMITTED.

Dated: June 10, 2011

[original signed by Matthew Ghikas]
Matthew Ghikas
Counsel for FortisBC Energy Inc.

[11] Exhibit B-1, BCUC IR 1.7.2 and 1.7.3.

Attachment 201.1

REFER TO LIVE SPREADSHEET MODELS

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(accessible by opening the Attachments Tab in Adobe)

Attachment 208.6.1

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Attachment 210.3

Maximizing Societal Uptake of Energy Efficiency in the New Millennium: Time for Net-to-Gross to Get Out of the Way?

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ABSTRACT

Humans are running out of time to reduce global warming gas emissions to avoid horrendous socio-political and environmental consequences. Reducing global warming effects may require an 80% decrease in greenhouse-gas emissions by the year 2050. This will require a sharp reduction in the use of fossil-fuels our modern civilization is based on. Widespread uptake of energy efficiency and conservation are the best options available to mitigate global climate change and provide time for developing more sustainable and renewable energy supply sources.

California's thirty-year promotion of energy efficiency provides valuable experience and an institutional and market infrastructure to broaden and deepen customer uptake of energy conservation and efficiency. California policymakers, entrepreneurs, and public show a heightened interest in energy efficiency.

To accelerate uptake of energy efficiency will require California to update evaluation policies and protocols for overseeing the almost one billion dollar per year publicly funded energy efficiency endeavor. Current evaluation is more focused on regulators need of attributing energy savings to specific programs and less so on optimizing interventions. Programs and evaluations are focusing mostly on energy efficient measures (EEMs) that get incentives.

This paper calls both evaluators and policy-makers overseeing energy efficiency portfolios to acknowledge the need for, and move to develop alternate evaluation policies, protocols and methods that will ensure publicly funded energy efficiency efforts are cost-effective, while also being supportive of non-traditional, more economical and deep market transforming interventions. These new evaluation policies and protocols should still ensure continued public oversight. The paper draws upon the California context to show how the Net-to-Gross ratio as currently applied inhibits new, market transforming energy efficiency interventions. Paper ends providing some initial thoughts on how to improve this situation.

Background

Society has long understood the crucial nature of energy to transform the natural world to get goods and services. This initially led to social support for the creation of an increasingly larger and complex energy supply system. With time, this evolution has been accompanied with an understanding that there are social costs that are not fully internalized by private markets and thus, suboptimal investments and developments occur in the energy sector.

This awareness of the suboptimal investment has led to a willingness to collect and use public funds to foster more socially optimal development of the energy sector. Energy efficiency programs funded with public funds is a good example. This public energy efficiency expense comes from a generalized understanding that the free market will not adopt higher efficiency on its own, nor will it

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[1] Any opinions expressed explicitly or implicitly are those of the author and do not necessarily represent those of Pacific Gas and Electric Company.

internalize the socio-politic or economic benefits and costs of the variety of energy infrastructure it has developed.

Public good funds for energy efficiency seek to maximize public benefits at minimum cost. Figuring out how to best use these public funds is complicated by a myriad of factors including risks, uncertainty, investment in short versus longer term opportunities, and various intervention strategies that seek to overcome perceived barriers to energy efficiency adoption.

In California and elsewhere (NW, NE and mid-west USA), publicly funded energy efficiency has a long history. In California, it is over 30 years old and has encompassed a variety of intervention strategies and administrative structures. Since 1996, these interventions have been mostly administered and run by the four investor-owned-utilities (IOUs), using public funds collected in rates. Regulatory oversight by the California Public Utilities Commission (CPUC) has sought to ensure IOU expenses optimize the use of these public funds.

As part of the determination of optimal use of these public funds, evaluation protocols have been established and significant evaluation efforts have been done to measure savings from these program interventions (check www.calmac.org for evaluation studies, and TeckMarket Works 2004, 2006). To ensure that funds are used in the best fashion possible, evaluation has focused on determining both gross savings and net savings by energy-efficiency-measures (EEMs) and/or programs. Gross energy savings encompass the totality of energy saved by programs or portfolios. Net savings refer to the energy saved that can be attributed to the programs beyond what would have happened anyways or "baseline". Gross energy savings are adjusted using a "Net-to-Gross" (NTG) ratio which in principle should include both an upwards adjustment for savings obtained beyond the program (spillover) and a downward adjustment for savings which would have happened anyways absent the program (free-riders).

California's four main investor-owned-utilities are currently administering a three-year, 2.1 Billion dollar publicly funded energy efficiency effort, under oversight and policy guidance by the California Public Utilities Commission (CPUC). The goals for this three year effort are to save 5.1 TWh, 2.2 GW and 111 MM Therms of natural gas. These goals are part of a longer-term effort that sought to save during 2004-2012 about 23 TWh, 4.9 GW, and 444 MM Therms.

Given the most recent findings of the Intergovernmental Panel on Climate Change, there is an interest in trying to save even more energy. Indeed, California Assembly Bill 32 calls for California to return to 1990 greenhouse-gas emissions levels by the year 2020 and the Governor issued an executive order that seeks to cut emissions by 80% by 2050.

For California to reach these goals, will require doing more transformative energy efficiency by tapping and engaging markets both broader and deeper than those to date. Broader in the sense that everybody will need to engage in energy efficiency. Deeper in that everyone will need to do more than what they have done. We will need full adoption of energy efficient lighting, premium motors, systems focused energy efficiency rather than individual energy efficiency measures (EEMs), as well as capturing process engineering enhancements, integration with renewable energy technologies, etc.

The current energy efficiency evaluation protocols are too focused on attribution of savings; counting only direct program participants energy saving actions corrected for free ridership. This focus promotes portfolios based on EEMs that are easy to measure and verify; undervaluing resources spent on programs that have longer lead times and/or high spillover effects. Although the current evaluation focus addresses the CPUC's need to minimize crediting of free rider savings, it also affects and impacts addressing other important societal goals, such as maximizing net energy savings and GHG emissions reductions.

The remainder of this paper explores how California's evaluation protocols, especially with regards to NTG may be inadvertently constraining the variety of interventions and resulting in reduced energy savings yields. The paper begins by drawing on the diffusion of innovation concept (Rogers 1995) to describe barriers faced by customers seeking to adopt more energy efficient technology. The discussion focuses on how the NTG can vary at the various stages of technological market adoption. This provides insights that are then exemplified with three possible new interventions that could lead to large energy savings with minimal public goods funding but that are constrained by the current evaluation protocols from happening. The paper ends by discussing how these protocols make broader and deeper efforts riskier given the high savings targets/goals; reducing energy efficiency administrators and implementers shy away from broader and deeper, higher spillover, market transforming interventions.

Current context requires and allows for new, more cost-effective energy-efficiency adoption interventions

At least two major issues with past evolution of the energy sector have recently heightened interest in tapping all cost-effective energy efficiency options first: Global Warming and Resource Adequacy. Global warming requires a significant reduction of Greenhouse Gas (GHG) emissions (some say up to 80% by 2050) to avoid most of the expected socio-politico-environmental impacts identified in the most recent IPCC reports. The frailty of the current energy supply system has become especially obvious in the wake of the California electricity crisis of 2000-2001, the large northeastern blackout of 2005, and Hurricane Katrina. Energy efficiency showed its worth to society during and after the California crisis, saving up to 14% of peak demand and 7% of electricity use in 2001; saving California from experiencing ongoing blackouts that summer. Energy efficiency is also recognized as the most cost-effective option for reducing GHG emissions, with a variety of energy saving measures costing less than 3 ¢/kWh and 1.2 $/MMBtu (Prindle et al. 2007). Energy efficiency and conservation reduces pollution and also gives time to develop better supply alternatives, especially renewable energy technologies and services, where technical breakthroughs and more importantly, market maturity is needed for full cost-effective deployment.

The current context is very receptive to energy-efficiency. There is increased public and private interest in energy efficiency. Corporations are seeking to enhance profits and their image among consumers and shareholders. GE's Ecomagination division had revenues of 17 Billion dollars in 2006; Walmart has established a group focused on sustainability and advertised its intent to sell 100 million compact fluorescent lamps (CFLs) in 2007; Home Depot gave away 1 million of these CFLs this past Earth Day; IBM has announced a 1 Billion dollar program to help its client data centers become more energy efficiency; and among automakers, Toyota and Honda higher energy efficient cars have fueled these two companies profitability and increasing market share over there less energy-efficient-focused competitors. Venture and pension fund capital managers are also increasing its interest and "seeding" new renewable energy and energy efficient technologies. The media is not far behind, with stories about global warming, energy efficiency, and renewable energy technologies showing up regularly in both local and national print and video media, as well as long-term stalwarts of "free markets" like the Economist (Sep 2006). Customer interest in these topics and eagerness to "do what's right" is an at all time high. We've even seen customers banding together to stop TXU's Board's recent interest in building eight new coal-powered power plants.

Albeit the increased interest in energy efficiency, studies still show that not all cost-effective EE is being adopted by customers, nor is ongoing development of products and services fully obtainable from business-as-usual (D Goldstein 2007; Itron 2006). This is the reasoning behind the ongoing support of energy efficiency promotion with public funds.

The question that arises is whether these funds are being spent in the most cost-effective and energy saving manner. It is also important to examine how current evaluation protocols and policies may be impacting what energy efficiency interventions are undertaken. This paper only examines the impact of NTG's policies, leaving for another discussion other areas that require review and possible revamping.

Let us examine what precludes customers from adopting all cost-effective energy efficiency and how NTG and its determination are not straightforward. Current California protocols regarding application of NTG in essence, by only counting free-riders, ignore non-energy benefits, which typically are the key leverage points to get customers to adopt more efficient services or products. New evaluation protocols with a broader perspective on overall societal benefits could increase research on customers and market actors resource efficiency motivators; providing insights for the development of more cost-effective public interventions.

Barriers to Capturing Energy-Efficiency Opportunities

The objective of a publicly funded energy-efficiency portfolio is to accelerate adoption of efficient energy use practices and technologies across a variety of customers served. Theoretically, successful public interventions spur along the maturation of energy efficiency markets so that these reach a "tipping point" where public interventions are barely needed. To succeed, the portfolio offerings need to take into account this varied mix of customers and their needs, continuously adapting to the changing context in which they are implemented. This requires a thorough understanding of customers needs to enable program offerings to align and produce optimal results. In California, even with over a quarter century of publicly funded energy-efficiency promoting programs, the energy efficiency market is still immature. Yet a new, energy-efficiency enabling context is growing; providing new opportunities for public resources to leverage private efforts to hasten market maturity. The key therefore is to clarify where markets are, what are the key barriers to further development of the market, and how to best tap into public and private resources to hasten tipping points for energy efficiency adoptions when these are possible, while still supporting the needs of less mature market segments.

This section briefly discusses key barriers faced by customers seeking to adopt energy efficiency. It also discusses how the barriers and context customers face change as an innovative product disseminates into the marketplace. This sets the stage for understanding why the CPUC's focus on attribution and rules regarding application of NTG lead to suboptimal results.

Energy-efficiency proponents talk about at least four major barriers that preclude customers (and society) from adopting all the cost-effective energy efficiency options (see Friedmann & James 2005; Friedmann 2006). These barriers are:

- Awareness. Where customers lack information on the options available, and/or their benefits.
- Availability. Manufacturers do not make or market more efficient measures as they do not expect to have a market for these (usually invisible) enhancements to their products.
- Accessibility. Distributors and retailers may not stock or aggressively display the EEMs making it hard for customers to find the more efficient products and services they seek.
- Affordability. Usually, EEMs are more expensive than the widgets they seek to replace, partly because of better quality components, partly because of their less developed and less competitive markets, with higher transaction costs to get these to market.

In order to address the barriers mentioned above, a public energy efficiency portfolio will include research, development and demonstration (RD&D) efforts, information and education components, programs to persuade customers to adopt more energy efficiency widgets and practices, and codes and standards to enhance the efficiency of buildings and equipment. The resources devoted to each of these public interventions will be determined by the market maturity context in which the decisions are made. They will change over time, across customer segments, and draw upon appropriate programmatic and project-level interventions as needed.

The programmatic and project-level interventions used need to address in more efficient and cost appropriate methods the changing needs of the market they seek to influence. Thus, the energy efficiency portfolio will be ever changing, reaching into new areas for further energy-efficiency, and contracting in others, where savings have been tapped out, or where markets have evolved and do not require further public support to continue to evolve.

The evolution of the dissemination of an energy efficient technology can be theorized to follow an S-shaped curve with four major market stages (immature, maturing, mature, and new EE technology markets) as shown in Figure 1 (Rogers 1995). An effective portfolio will optimize the mix of offerings to best address the challenges being faced by each of these four stages of market evolution to align benefits with societal needs. The intent is to match portfolio offerings to market needs, and to do so at crucial leverage points. Some of these efforts will be upstream, midstream or downstream, and/or geographically defined.

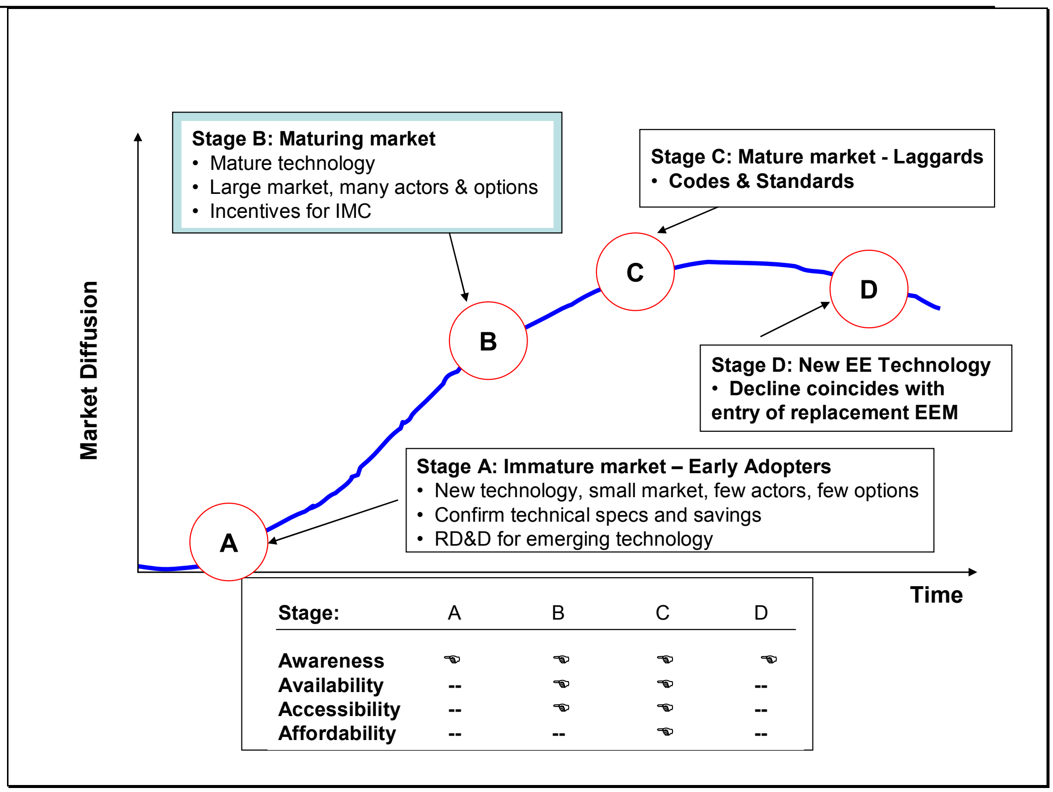

Figure 1. Market Evolution Curve for an EEM or EE Practice and Barriers Faced at Each Stage

There are important linkages among these four stages of market evolution. Stage A describes the early stages of a new technology or practice. Typical interventions for this stage focus on research, development and demonstration (RD&D). Decisions on what technologies or practices to include in the portfolio in Stage A depend on the remaining significant opportunities for energy savings. These depend in part on the previous maturation of other energy-efficiency measures addressing the more important customer energy end-uses. Indeed, Stage A and Stage D are interlinked, as the new technologies or practices being developed in Stage A begin to reduce the saturation in the market of the technology or practice that was previously being promoted by market interventions in Stages B, C and D. In Stage B, a technology or practice has become better known, is more available, accessible, yet still most likely, significantly more expensive than the less efficient technology or practice it seeks to supplant. Stage B is where most portfolio resources are typically spent currently, in the form of audits and incentive programs to help reduce the incremental costs of efficient measure's adoption. In Stage C, most of the customers have adopted the more efficient technology or practice, but some significant portion of the customers is unlikely to ever adopt it. In Stage C standards and codes are typically the intervention of choice to ensure that all customers adopt the more efficient technology given its significant societal benefits. By Stage C, the efficiency interventions administrator needs to be identifying and beginning to develop the next generation of technologies and/or practices to introduce (and start their own Stage A). This is reflected in Stage D, where the saturation of the current efficient technology is being impacted by the growing market presence of the next generation, even more efficient technology already in its own Stage A or perhaps even Stage B.

Eventually, as the private energy efficiency market grows and matures, one would hope that public support would center on Stages A and C, leaving private market actors to address most of Stage B. In this ideal theoretical construct, public funds would be used where most effective (namely where the private sector would not invest adequately due to the public good nature of that market), and be supplemented largely by private market actors positioning themselves to serve the maturing market customer in Stage B. Indeed, public resources would be used to guide and also provide credibility to private actors' best energy efficiency offerings in Stage B. This public-private market segmentation has only begun to occur in a few select situations, for example, with CFLs in homes and T-8 fluorescent bulbs in businesses. Even in these two cases, private market actors still look for various types of support from publicly funded programs. These public programs also are involved in coming up with the next generation of lighting products: LED and T-5 fluorescent lighting.

NTG and Maturing Markets for Energy Efficiency

Drawing from the diffusion of innovation for energy efficiency products and services curve, and the barriers inherent to each stage of market evolution, we examine here what factors affect the Net-to-Gross (NTG) ratio for any public interventions and the likely resulting value for NTG (see Table 1).

NTG at each stage of dissemination of innovation is different, as the key four barriers impact varies. NTG may be high in early adopter—because there is very low availability, accessibility for EEMs in Stage A. Although affordability and awareness also very low among the general population, they are actually high among the early adopter crowd. Thus, what the overall NTG—when defined as "what would have done without the program" depends on whether early adopters would have indeed been aware of the technology and been willing to spend more and seek it out to overcome the availability and accessibility barriers. Worse, should someone just focus on the early adopter participant customer's NTG it is likely the NTG would be quite low, and possibly lead to a decision to discontinue supporting the evolution of its' market. In this situation, spillover happens over time. Although the early adopters' NTG is low, through their actions and public support of market actors becoming engaged in the EEM, you are moving this technology to Stage B. Thus, just focusing on the early NTG, could lead to a decision to stop public support of the incipient EEM market, long before it is ready for uptake by the majority of customers and at least delaying capturing this technology's savings.

Table 1. NTG for Evolving Markets of EE Technologies

Market Stage	Participant Characteristics	Net-to-Gross Issues Of Participants
A. Immature	Early adopters. Embrace new technologies quickly	Awareness, affordability, accessibility, availability all low—imply high NTG; yet propensity to adopt is high among early adopters, possibly resulting in low NTG
B. Maturing	Majority of market. Require information, incentives, and other support to adopt efficient products	Relatively high NTG as these customers not "primed" to adopt new technologies and require information to be made aware, market support via upstream/midstream programs to enhance availability and accessibility, and incentives to improve affordability
C. Mature	Reticent/laggards. Lag at adopting new technologies or practices	Very high NTG as these customers very reticent to adopt EEMs. Indeed, C&S are used to force adoption, and even then, compliance with them can be very spotty
D. Decline	Back to early-adopters.	NTG indeterminate, depending on market barrier being faced for new, replacement EEM

In Stage B, all four barriers of awareness, availability, accessibility and affordability are being lowered. At this stage, the NTG for early adopters is low given the very high free-ridership; but for the mainstream customer, NTG is probably quite high initially and then, starts to decline as the market for the technology continues to mature.

In Stage C, all four barriers have been mostly overcome. The NTG is very low for both early adopters and mainstream customers, but very high for the late/never adopter. Adoption by the late adopters is obtained through mandatory energy efficient Codes and Standards. Yet compliance with the Codes or Standards remains a problem. NTG for these laggard customers is very high, but very low for all other customers.

We have seen that NTG is very dependent on the stage of market development for the energy efficient product being considered. Also, the rules on how NTG is applied can heavily influence the portfolio of energy saving strategies pursued. The market context within which we are seeking to enhance customer adoption of a particular energy efficiency product is also important. After 30 years of efforts and with the increased public and private interest in GHG, fossil fuel availability and socio-political implications of our dependence on them, it is becoming very hard to accurately estimate a NTG for a specific program intervention or EEM. Given the current context and energy savings goals under which California's energy efficiency programs are operating, it seems that a revision of the policies and their focus on NTG is needed. How these two aspects come together is discussed next.

NTG and Big, Bold Efficiency Interventions

In the search for new options to continue to garner energy savings and their accompanying socio-economic-environmental benefits to society, the question of how NTG (among other evaluation protocols) affects the possibility of carrying out effective new big and bold ventures comes up. We briefly describe three possible interventions being considered for the PG&E service territory and explore how current rules regarding NTG increase the risk of meeting savings goals making these interventions less interesting for the utility to pursue.

CFLs – Getting deeper and broader adoption by customers

About 31% of California homes have yet to install a single CFL. Of the remaining 69% of homes who have installed CFLs, only about 17% have installed 15 or more CFLs and can be assumed to have fully saturated their home lighting with CFLs (RLW 2005). Therefore, probably about half or more of the residential lighting is still using inefficient incandescent lights. According to the latest energy efficiency potential study (Itron et al. 2006), full saturation of CFLs would imply slightly over 100 million installed CFLs in PG&E serviced homes. The same study estimated at 53 million CFLs the maximum achievable saturation between 2004-2016. PG&E is seeking to accelerate adoption of CFLs via an upstream/midstream market program that offers about $2/CFL to manufacturers and distributors and retailers. This allows retailers to sell the CFLs for $1 each. Sales volumes have been increasing rapidly with up to 25 million expected in 2007, up from almost 7 million in 2006 and 4 million in 2005. Should this growth continue, PG&E homes will be close to CFL saturation in 2 to 3 years. The program has very low administrative costs by offering the incentives to manufacturers, distributors and retailers instead of customers. Yet this makes determining NTG very difficult, as participant contact information is unavailable. Instead success could be measured in terms of product availability, accessibility, affordability, and awareness. A survey of households (given that about 69% have CFLs) would still be hard pressed to get a reliable value for free-ridership given the multitude of energy efficiency messaging and promotions going on in the marketplace and that PG&E's incentive is almost invisible to the customer. Current evaluation protocols do not allow credit for any spillover, further reducing the per-protocols, official cost-effectiveness of the CFL upstream program. The program strategy is successful but can easily result in mistakenly high free ridership estimates. If the free ridership estimates come out too high, PG&E may decide to end this program (which also helps promote higher quality CFLs that have more of the characteristics customers want and that usually have led to rejection of CFLs in the past), before the CFL market is fully tapped out, leaving significant energy savings untapped.

Large Commercial Office Buildings

PG&E is currently offering a variety of products and services to large commercial office buildings. These include audits, retro-commissioning and commissioning, design-assistance, incentives for more efficient equipment, training on both, opportunities and enhanced operations and maintenance, etc. Customer outreach is mostly via PG&E Assigned Service Representatives (ASRs). The idea is that large office building managers can avail themselves of a variety of energy efficiency services to meet their needs through just one point-of-contact. Research is being conducted to allow for an even better focused program to meet this market segment needs. The idea is to characterize the large office buildings in PG&E territory by ownership and management set-up. PG&E will then reach out to these building owners and operators at the most appropriate levels of decision-making on energy-related investments, with appropriate messaging and utilizing the most appropriate PG&E staff level. This will imply establishing long-term relationships at various levels of both PG&E and the large office building manager or owner that will enhance uptake by the customers. Rather than focusing most of the effort on incentives, it is quite likely that efforts will be required at non-rebated aspects of the business decision. Tracking and determining the ultimate influence on energy savings of this variety of interventions among a variety of decision-makers (e.g., across the engineering or capital investments leadership within these organizations) over a long period of time, will be very difficult, and figuring out a free-ridership ratio even more difficult. How would one apportion such a free-ridership if say 8 of 9 decision makers were totally keen on adopting the technology (i.e., free riders) yet the 9th and final decision maker (or even the first one on the decision-tree) only agreed to the enhancement thanks to the intervention of PG&E? How will a NTG based only on participant free-ridership underestimate the energy savings from spillover, within the organization and variety of decision-makers involved and their impact on their peer groups and over time? How interested will PG&E be in pursuing this business model if there is a high level of risk on what savings will be ultimately apportioned to its efforts, partly because of current protocols governing NTG and the difficulty of estimating it?

Data Centers—Brave New World

PG&E estimates data center load growth at between 400 and 500 MW. A variety of hardware and software options are now available that can cost-effectively reduce the energy used by these data centers by one-half or more. This requires implementation of a variety of measures in a synergistic fashion, including the promotion of standards and metrics for data center equipment, and promotion of improved data center designs and operation schemes. Outreach and promotion from a credible source such as PG&E (who does not sell the equipment) is crucial. As PG&E only sells energy to these data centers, its efforts to promote a variety of products and services being offered by a variety of firms (including IBM, HP, Sun, Intel, VMWare, etc.) are providing critical credence to the claims of these various vendors as well as optimal integration of the services and products offered by them. PG&E also sponsored a data center design charrette in 2005 that helped develop ideas on how to improve energy efficiency in these facilities. Yet, how will the savings from these efforts be apportioned among the entities involved? Given that affordability is not a key issue for this market, whereas awareness and credibility are, how will free-ridership be measured? Given the quick uptake and high turnover of personnel typical of this marketplace, with the expectation that about half of it will have adopted for example virtualization (whereby they can get rid of about 70-80% of the servers and cooling needs of a data center by increasing the load from 10% to 70% in each server), will evaluations be able to gather reliable free ridership (or spillover) data before the market is basically transformed? Given the large savings being obtained with minimal public resources, this effort appears to be very cost-effective and something to try to emulate in other markets. Under current policies it is unclear what savings will be attributed to PG&E's efforts.

These three examples show issues around using NTG (especially based solely on free-ridership), and how focusing on attribution of savings is not only near impossible for these big and bold strategies, but worse, makes these very risky endeavors for PG&E to pursue.

California Needs New Evaluation Protocols for Energy Savings Attribution

Given the rapidly changing, increasingly embracing energy efficiency context we live in California, it is imperative to develop new evaluation methods, policies and protocols that will help guide and ensure optimal use of public energy efficiency resources. These new policies and protocols should foster leveraging much larger private resources with carefully crafted public interventions.

Current California protocols and CPUC rulings need to be updated to increase the focus on maximizing social benefits accruing from public resources, to balance these goals with the current one that focuses on attempting to attribute savings to specific public efforts; and take advantage of a societal context where there is a large opportunity for saving energy by leveraging market actors resources. There is an increasing level of activity from private market actors that is tapping into energy efficiency regardless of the presence of publicly funded, utility administered efforts. Customers are more interested in adopting energy efficiency than ever before as they try to do their part to solve a variety of issues they care about (Climate Change, USA's "addiction to oil", Iraq war, etc).

Utilities need to meet goals that are set at levels that are hard to achieve under current rules governing what counts or does not if they are to get shareholder incentives for their energy efficiency efforts. The CPUC requires evaluations to estimate NTG, but only considering free riders, with no credit for spillover savings. Given current market conditions, it is impossible to estimate a reliable free-rider-based NTG and/or spillover. Furthermore, the reticence to accept spillover leads to increased resources being assigned to programs where the savings not only are "counted" but also, "attributable" and help programs meet their large energy savings goals. Current policies lead implementers to avoid programs that may have large spillover effects; in essence spending the resources in less cost-effective efforts. And to add insult to injury, yesterday's spillover (that you never accounted) turns into today's baseline. In the long run this leads to underestimation of energy savings and cost-effectiveness.

The inordinate focus on attribution also takes away resources that could be used to better understand the markets we are trying to influence, thus detracting from the quality and depth of the information we use in designing and running publicly funded energy saving interventions. Evaluation activities are thus done in an institutional framework that determines the scope of the activities and analyses undertaken. The majority of energy efficiency programs are done with public monies overseen by a public entity. This institutional framework leads to evaluations that cater to the needs of ensuring public oversight, but not necessarily clearly identifying the needs of customers, or the programs that attempt to get customers to adopt energy efficiency. As these are the major evaluative efforts, they also affect the evaluation community framing the scope of enquiry and methods. In my view, the current framework may be giving us a distorted view-as it does not encompass other issues that may be crucial at really finding out what works, as efficiency markets evolve.

As the CPUC gets ready to define energy efficiency goals for 2009-2011, there is an increased awareness of the changing context, the increased difficulty for determining NTG, and the need to review the rules and evaluation protocols under which the IOUs administer the energy efficiency public endeavors.

Of late, there is a growing concern among evaluation practitioners about the capability of estimating accurately NTG and attribution of savings to specific programs given the current context, and/or using these to design program offerings (see recent conference proceedings of AESP 2007, IEPEC 2006, and Barnes 2007; Chappell et al. 2005; R Friedmann 2005, 2006; Saxonis 2007). Market effects indicators appear to be the preferred choice at this juncture (Chappell et al. 2005). Much more work is needed here to develop new indicators and then protocols aligned with them to foster the ongoing evolution of energy efficiency markets and energy savings by customers.

Conclusions

Paper has shown that the current context in California allows for new energy efficiency intervention strategies. Given the private market's interest in selling or adopting energy efficiency to increase profits and show good corporate citizenship and customer's increased interest to "do what's right", publicly funded efforts can change their "mainstream" efforts to interventions that optimize leveraging of private market actor efforts. Publicly funded efforts will still need to deal with creating new options for early adopters as well as addressing "laggard" customers via Codes and Standards. It is with the mainstream customer that publicly funded efforts can now let the relatively mature California energy efficiency market take a bigger role and even the lead, and intervene with public funds to "oil" this private markets' machinery.

Current evaluation policies and protocols make difficult such a change in public energy-efficiency interventions. They insist on calculating free-ridership and not allowing for savings from non-incented energy efficiency improvements. Changing current policies to allow for counting spillover from participants and non-participants needs to be addressed.

But both spillover and free-ridership are becoming much harder to determine as the context becomes one that embraces energy efficiency (for a variety of reasons that have little to do with saving energy). Therefore, new evaluation metrics, methods, policies and protocols need to be developed to better understand customer adoption decision-making, identification of key leverage points in the markets for energy efficient products and services, so that publicly funded interventions can continue to focus their efforts in the most cost-effective and socially beneficial manners.

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Attachment 212.1

SAMPSON RESEARCH
Consulting

EVALUATION OF TERASEN'S 2005-07 HEATING SYSTEM UPGRADE PROGRAM

FINAL REPORT

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Disclaimer

The opinions expressed in this report are the responsibility of the author, Sampson Research, and do not necessarily represent the views of Terasen Gas.

Currency Units

All dollar figures presented in this report, unless stated otherwise, are expressed in Canadian funds

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Evaluation of Terasen's 2005-07 Heating System Upgrade Program

Executive Summary

This report summarizes the findings from the first phase of a two-phase evaluation of Terasen's 2005-07 Heating System Upgrade Program. The program offered a financial incentive of $250 towards the purchase of an Energy Star® qualified high efficiency natural gas furnace or boiler, and an additional $100 incentive if the customer chose a qualifying furnace / boiler equipped with a variable speed drive (VSM) motor. Incentives were in effect from September 2005 to March 2007. The primary objectives of the program were to reduce energy consumption and peak demand associated with the existing residential home heating applications, and to reduce greenhouse gas emissions by increasing the energy efficiency of home heating systems.

Evaluation objectives for the first phase of the two-phase evaluation included:

- Assessing the reasons for program participation, the effectiveness of program marketing / advertising, free ridership, reasons for non-participation, and overall customer and trade ally satisfaction with the program.
- Assessing program impact on sales of qualifying high-efficiency furnaces (HEF), and variable speed blower motors (VSM), for both participating and non-participating customers.
- Documenting and assessing program impact on furnace and secondary heating operating behaviours that affect energy use, with particular emphasis on hours of operation.
- Determining the status of market transformation for high efficiency furnaces, and furnaces with variable speed drive blower motors in the British Columbia market.
- Developing preliminary estimates of program impact on natural gas sales and carbon dioxide emissions.

The objectives of the first phase of the evaluation were addressed using data and information gathered from a combination of program records and primary research with customers and trade allies (furnace dealers and installers). Primary data collection efforts consisted of telephone surveys conducted with representative samples of:

- program participants (n=100);
- non-participants (n=100); and
- furnace dealers, contractors, and installers (n=50).

All surveys were conducted over the telephone during September 2007. Data on program participation, including the preparation of the survey sample frames, was the responsibility of Terasen. Implementation of the surveys was contracted by Sampson Research to Call Us Info Inc.

The second phase of the evaluation (scheduled for autumn 2008) will conduct a billing analysis of participating and non-participating customers to firm up estimates of program savings. This latter phase will commence after study participants have accumulated sufficient billing history (one full heating season) with their new furnace. Phase two will also use data gathered from the market research conducted under phase one of the evaluation.

The conclusions of the study are as follows:

***Objective 1: Assess the reasons for program participation, the effectiveness of program marketing / advertising, free ridership, reasons for non-participation, and overall customer and trade ally satisfaction with the program*.**

Understanding the importance of Terasen's Heating System Upgrade Program to the decision to install a high efficiency rather than a standard or mid-efficiency furnace is essential to the attribution of energy savings to Terasen's program. In this regard, 57% of participants in the Terasen program credited the program with influencing their decision to purchase a high efficiency furnace, meaning that 43% of participants were free-riders and would have selected a high efficiency furnace without the incentive. The free rider estimate is consistent with the fact that 38% of non-participants that were unaware of the Terasen program installed a high efficiency furnace. Based on information provided by participants, the proportion of free riders for the 2005-07 program is estimated at 43%. This is an increase from 28% estimated for the previous program. The increase is consistent with the continuing transformation of the furnace market to high efficiency units.

Thirty percent (30%) of participants credited the program and its incentives for their decision to replace their furnace, on average, 2.3 years earlier than planned. This is consistent with the significantly higher proportion of participants than non-participants reporting that their old furnace was still operational at the time of replacement (91% versus 71%).

Satisfaction scores assigned to various program attributes by program participants, based on a five-point satisfaction scale, were generally favourable, with the highest score given to application procedures (4.1) and the lowest score given to size of the rebate (3.7). Trade allies also rated the program positively using the same five-point scale with the highest satisfaction score given to the types and number of furnaces eligible for a rebate (4.2), and the lowest score given to the size of the rebate (3.6).

Participants in the program attributed their awareness of the program to an insert in their Terasen bill (29% of participants), heating or furnace contractor (26%), word of mouth (21%), and direct mail from Terasen (15%). Success in program marketing is often reflected in word of mouth traffic. The Terasen program appears to have successfully achieved this result.

More than half (52%) of Terasen's residential customers who replaced their furnaces during the past three years and did not participate in the Terasen program were simply unaware the program existed. The next most common reasons for not participating (mentioned by anywhere from 17% to 19% of non-participants) included the dollar amount of the rebate (i.e., too small), the hassle factor with applying for the rebate, and the fact that the furnace they chose did not qualify. Ten percent (10%) of non-participants indicated they had applied to the program but had their application rejected.

Participants in Terasen's Heating System Upgrade Program are generally very satisfied with their high efficiency furnace. Ten percent (10%) reported experiencing problems with their new furnace, but only 2% reported having major repairs. A large percentage (71%) of participants reported improvements in the comfort of the home after installing their high efficiency furnace. In contrast, 42% of non-participants reported improvements in home comfort after installing their furnace. Customers installing VSM-equipped furnaces were significantly more likely than those installing PSC-equipped furnaces to experience an increase in home comfort (68% versus 43% respectively).

***Objective 2: Assess program impact on sales of qualifying high-efficiency furnaces (HEF), and variable speed blower motors (VSM), for both participating and non-participating customers*.**

Information provided by customers and trade allies during the 2004 and 2007 furnace evaluations confirms that the replacement furnace market in British Columbia is moving towards high efficiency furnaces. Trade allies reported that high efficiency furnaces represented 48% of all replacement furnace sales prior to the launch of the most recent program. This share rose to 65% during the program and then declined to 56% after rebates ended in March 2007. VSM-equipped furnaces (either mid- or high efficiency) accounted for 34% of all furnace sales prior to program launch, and 44% following the program conclusion. Trade allies reported the share rising to 56% while the program was in operation.

Forty-three percent (43%) of non-participants reported installing high efficiency furnaces, while 39% installed standard or mid-efficiency furnaces. The remaining 13% of non-participants were not sure of their furnaces' efficiency. The decision not to install a high efficiency model was influenced by first cost, length of payback period, and a general lack of awareness of the relative costs and benefits of high efficiency furnaces. Non-participants were more likely than participants to have annual household incomes of less than $40,000, meaning that the relatively higher cost of a high efficiency furnace (approximately $700 more than a mid-efficiency furnace) was more of a financial hurtle for these households.

The top three reasons for installing a furnace equipped with a variable speed motor were the desire to save electricity (mentioned by 42% of participants), the contractor's recommendation (35%), and the $100 incentive offered by Terasen and its partners (11%). Trade allies were somewhat less likely than customers to attribute the decision to purchase a VSM-equipped furnace to the influence of the rebate (53% versus 57%). The customer-based estimate of free riders was used in the analysis of program impact.

Objective 3: Document and assess program impact on furnace and secondary heating operating behaviours that affect energy use, with particular emphasis on hours of operation.

Four factors influencing furnace operating costs (and savings) were explored in this evaluation – changes in furnace fan operating behaviours, changes in thermostat setting, changes in operating settings, and changes in supplementary heating.

How homeowners use their furnace to heat or cool the house, or to provide ventilation either occasionally or continuously before and after the installation of a VSM-equipped furnace affects the amount of electricity savings realized from the VSM blower motor. The economics of VSM furnace fans depend on operating hours – low operating hours significantly increases the payback period for VSM-equipped furnaces.

This evaluation found that, regardless of the furnace blower type, the number of households using their furnaces to intermittently heat or cool their homes during the heating/cooling seasons declined after installing their new furnace, and a proportion increased their use of the fans to provide continuous heat or cooling during the heating / cooling seasons. The data is inconclusive as to the influence of blower motor choice on behaviours as a significant proportion of households installing furnaces equipped with PSC motors also changed their usage to one of providing more continuous heat or cooling, or to provide ventilation for part of the year . Households that installed VSM-equipped furnaces, however, were more likely to use their fans continuously.

Executive Summary

The evaluation found that households who replaced their old PSC-equipped furnaces with a VSM-equipped furnace are comprised of several user types – with no conclusive evidence to suggest that households that used their old furnaces either continuously for heating/ cooling, continuously, or to provide ventilation were predisposed to purchase a VSM-equipped furnace. Instead, energy efficiency, the recommendation of the contractor, and non-energy benefits (e.g., improved comfort, improved air quality via air circulation, pollen filters, etc.) appear to have been more important considerations. Interestingly enough, some households purchasing VSM-equipped furnaces appear to have had unrealistic expectations regarding the electricity savings potential of VSM blowers, as they rated their satisfaction with electricity bill savings from their VSM-equipped furnaces significantly lower than households who purchased PSC-equipped furnaces (3.8 versus 4.2 using a five-point satisfaction scale). Data on furnace fan operating behaviours prior to furnace change out suggest that a significant number of households installing VSM-equipped furnaces tended to use their old furnace fans only intermittently, implying their electricity bill savings would be less significant that those who operated the fans more frequently or continuously.

Changes to Furnace Thermostat Setting

Only 4% of participants and 11% of non-participants increased their thermostat setting to keep their house warmer since installing their new furnace. A significantly greater proportion of participants than non-participants reported turning down the thermostat since replacing their furnace (22% versus 9%). When increases or decreases in temperature (in degrees Celsius) are added to those who reported no change, the net change in indoor temperature for participants was minus 0.6 degrees Celsius compared to plus 0.4 degrees for non-participants. This suggests that participants are maintaining their home temperatures a full degree lower than non-participants, effectively adding to the energy savings attributable to participation in the Terasen program.

Changes to Furnace Operating Settings

Only 5% of participants and 1% of non-participants reported changing one or more operating settings. Participants mentioned changing the furnace to run less frequently, resetting the blower, installing a digital readout, and installing air conditioning. The non-participant reported adjusting the timing of the second stage burner so that it engaged sooner.

Changes to Supplementary Heating

The evaluation found that participants were significantly more likely than non-participants to reduce their use of supplemental heating after replacing their furnace (-16% versus -2%). This suggests that participants' new furnaces are picking up some of the heating load previously met through supplemental sources, most notably the natural gas fireplaces, and to a lesser degree, electric heaters. The transfer of the heating load to the new furnace may result in additional savings as the furnace will be more efficient than the natural gas fireplace. However this may be partially offset if supplementary heating in the pre-furnace change-out period was being used to improve the comfort in the home or parts of the home (e.g., temperature variations between rooms, temperature fluctuations between furnace cycles, etc.). The forthcoming refinement of program savings using a billing analysis will, by its nature, capture these changes in supplementary heating use and the net impact of other changes in heating/cooling use.

Objective 4: Determine the status of market transformation for high efficiency furnaces, and furnaces with variable speed drive blower motors in the British Columbia market.

Market transformation is measured, in part, by changes in market shares of high efficiency products, and declines in the relative price differential of high efficiency units relative to standard efficiency units.

High efficiency furnaces' share of the replacement furnace market rose from 48% prior to program launch to 65% during the program phase, before retreating to 56% after the conclusion of the program. A review of market share data from the past and present evaluations suggests a moderate pullback in the market when no program is in place.

Trade allies reported that 54% of all furnaces replaced between September 2005 and March 2007 were eligible for a rebate from Terasen Gas or its partners.

Trade allies reported that the share of the replacement furnace market represented by VSM-equipped furnaces increased from 34% in the pre-program period to 56% during the program, and then falling to 44% in the post-program period. Terasen's program records indicate that 65% of participants in the heating upgrade program installed a high efficiency furnace equipped with a VSM blower motor. A review of historical market share data suggests that like high efficiency furnaces, VSM market shares seesaw when programs are in effect versus when they are not, although the general trend is upward.

A comparison of equipment and installation costs provided by trade allies surveyed in 2003 and 2007 suggests that equipment prices for all furnace models regardless of efficiency increased over the four-year period, while installation costs either stayed the same or declined somewhat. High efficiency furnaces still cost more on an installed basis than mid- or standard efficiency units. The incremental cost of installing a 75,000 BTU/hour high efficiency furnace compared to a 90,000 BTU/hour mid-efficiency furnace (comparable in output based on efficiency) is $696, down from $877 in 2002, but up somewhat from $608 in 2003.

Objective 5: Develop preliminary estimates of program impact on natural gas sales and carbon dioxide emissions.

Energy savings attributable to Terasen's 2005-07 residential Heating System Upgrade Program, using a net to gross ratio 0.57, include 66.1 terajoules (TJ) in annual savings, plus an additional 22.6 TJ of savings for the first 2.3 years (spillover). Estimated peak day savings are 0.48430 TJ for the first 2.3 years, and then 0.36091 TJ for the remaining years. Assuming an emissions factor of 50 tonnes carbon dioxide per terajoule of energy saved, Terasen is credited with reducing CO^2 emissions from residential furnaces by 4.435 kilotonnes in the first 2.3 years, and 3.305 kilotonnes for subsequent years.

1 Introduction & Objectives

This report presents the results of the first phase of a two-phase evaluation of Terasen's 2005-07 Heating System Upgrade Program. The program offered a financial incentive of $250 towards the purchase of an Energy Star® qualified high efficiency natural gas furnace or boiler, and an additional $100 incentive if the customer chose a qualifying furnace / boiler equipped with a variable speed drive (VSM) motor. Incentives were in effect from September 2005 to March 2007. The primary objectives of the program were to reduce energy consumption and peak demand associated with the existing residential home heating applications, and to reduce greenhouse gas emissions by increasing the energy efficiency of home heating systems.

Evaluation objectives for the first phase of the two-phase evaluation included:

- Assessing the reasons for program participation, the effectiveness of program marketing / advertising, free ridership, reasons for non-participation, and overall customer and trade ally satisfaction with the program.
- Assessing program impact on sales of qualifying high-efficiency furnaces (HEF), and variable speed blower motors (VSM), for both participating and non-participating customers.
- Documenting and assessing program impact on furnace and secondary heating operating behaviours that affect energy use, with particular emphasis on hours of operation.
- Determining the status of market transformation for high efficiency furnaces, and furnaces with variable speed drive blower motors in the British Columbia market.
- Developing preliminary estimates of program impact on natural gas sales and carbon dioxide emissions.

The second phase of the evaluation (scheduled for autumn 2008) is to conduct a billing analysis of participating and non-participating customers to firm up estimates of program savings. This latter phase will commence once study participants have accumulated sufficient billing history (one full heating season) with their new furnace. Phase two will also use data gathered from the market research conducted under phase one of the evaluation.

The objectives of the first phase of the evaluation were addressed using data and information gathered from a combination of program records and primary research with customers and trade allies (furnace dealers and installers). Primary data collection efforts consisted of telephone surveys conducted with representative samples of:

- program participants (n=100);
- non-participants (n=100); and
- furnace dealers, contractors, and installers (n=50).

All surveys were conducted over the telephone during September 2007. Data on program participation, including the preparation of the survey sample frames, was the responsibility of Terasen. Implementation of the surveys was contracted by Sampson Research to Call Us Info Inc.

Introduction & Objectives

1.1 Report Organization

The main body of this report is organized into six sections. Following the introduction, Section 2 provides an overview of high efficiency furnace design and characteristics, an overview of the Terasen Heating System Upgrade Program, and a discussion of issues, data sources, and methodologies used in the evaluation. Section 3 summarizes the findings from the telephone survey of participating and non-participating customers. The results from the survey of furnace dealers and contractors (trade ally survey) are summarized in Section 4. The analysis of the program's impact on customer behaviours, the replacement furnace market in Britsh Columbia, and energy and carbon dioxide emissions is presented in Section 5. Summary and conclusions are presented in Section 6. A bibliography of publications referenced in the report is found immediately after Section 6.

This report is accompanied by three appendices. Appendix A includes the participant and non-participant survey questionnaires. Appendix B includes the trade ally survey questionnaire, the steps and analysis undertaken by Terasen staff to prepare the samples of participants, non-participants, and trade allies for use in the surveys are documented in Appendix C. Appendix D presents expanded tabulations for select questions from the customer and trade ally surveys.

2 Background & Methodology

2.1 Furnace Efficiency

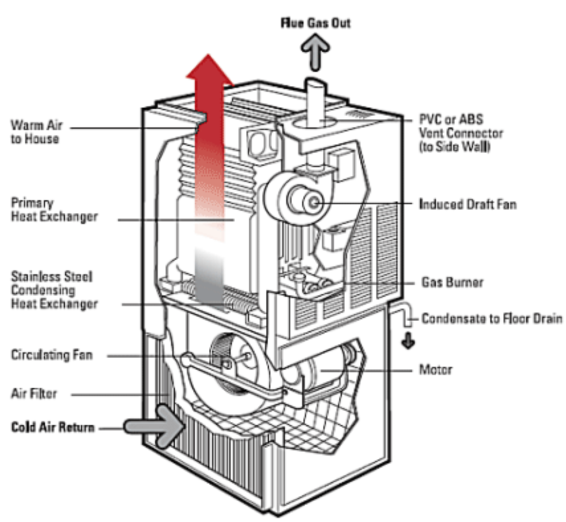
The efficiency of home heating systems is measured by the annual fuel utilization efficiency (AFUE) rating. The AFUE rating is the ratio of the heat output to the total energy consumed by the furnace. An AFUE rating of 90%, for example, tells homeowners that every dollar spent on energy will deliver 90 cents of heat output. Based on their efficiency rating, furnaces are typically grouped into one of three possible efficiency classes: standard efficiency, mid-efficiency, or high efficiency. High efficiency furnaces are also known as condensing furnaces.

Standard efficiency furnaces have a seasonal AFUE of 60% to 70% and typically use a standing pilot light, a single stage heat exchanger (captures heat from the combustion of the natural gas), and draw air for combustion from inside the house. These furnaces require a chimney to expelled combustion gases to the outside of the house.

Mid-efficiency furnaces have a seasonal AFUE of 78% to 84%, use electronic ignition, a draft hood, and incorporate a power controlled vent fan to reduce indoor air lost up the chimney. This is the base level of efficiency available for sale in Canada.

High efficiency or condensing furnaces represent the most efficient furnaces available with an AFUE of 90% to 97%. They are characterized by electronic ignition and a secondary heat exchanger that recovers 10 to 17% more of the heat given off by combustion. Some draw air for combustion from a pipe to the outside of the house. The heat extracted from the combustion gases causes the gases to cool to the point that they condense (turn to water). The remaining gases are cool enough to be vented to the outside by way of a PVC or ABS pipe. The condensate (water) empties to a floor drain. A cutaway schematic of a high efficiency furnace is presented in Exhibit 1.

Exhibit 1: Cutaway Schematic of a Typical High Efficiency Condensing Furnace



Source: "Choose the Right Condensing Gas Furnace" fact sheet published by Natural Resources Canada, http://oee.nrcan.gc.ca/publications/infosource/pub/gas-furnace-2007/index.cfm

2.2 Energy Star®

Terasen's Heating System Upgrade Program required that all furnaces eligible for a rebate be Energy Star® qualified. Energy Star gas furnaces and boilers represent the most fuel efficient units in their class, having met the efficiency and quality criteria set by the Energy Star program. Energy Star qualified furnaces display the Energy Star symbol (Exhibit 2) on the furnace, on the packaging, or in promotional or educational literature. Currently, Energy Star qualified gas furnaces have an annual fuel utilization efficiency (AFUE) rating of 90% or more. Most leading manufacturers of home heating and cooling equipment are producing high-efficiency systems that qualify for Energy Star certification.

Exhibit 2: Energy Star Label

2.3 Furnace Fans

Furnace blowers (fans) are operated by either a Permanent Split Capacity (PSC) motor or the more energy-efficient Electronically Commutated Permanent Magnet (ECPM or ECM), also commonly referred to as a Variable Speed Motor (VSM). PSC motors can be set up to operate at any one of up to four speeds to match the needs of the installation, with maximum efficiency achieved at their highest speed. When operated at lower speeds, the efficiency of a PSC motor quickly drops off. VSMs, by comparison, operate through a range of speeds, with their efficiency maintained by electronics. They use less energy than PSC motors throughout their operating range – with estimates ranging from 20% to 50% less depending upon how the homeowers use their furnace fans. In addition to their higher efficiency, VSMs typically last longer and run quieter.

Some furnace blowers are run continuously at a low speed during the heating season to improve home comfort. Some homeowners install central air-conditioning systems that utilize the same furnace blower. Both practices dramatically increase annual electrical consumption by the furnace, compared with the traditional demand-only mode of operation during the heating season. The electricity savings achieved from switching from a PSC-equipped furnace to a VSM- equipped furnace are maximized if the furnace fan is typically operated in either continuous mode or to provide ventilation in addition to intermittent heating.

Some of the gas savings from a furnace equipped with a VSM motor will be offset by the need for the furnace to supply heat traditionally given off by the lesser efficient PSC motor. However, when central air conditioning is used, VSM blower motors will provide additional savings since they give off less heat than a PSC motor.

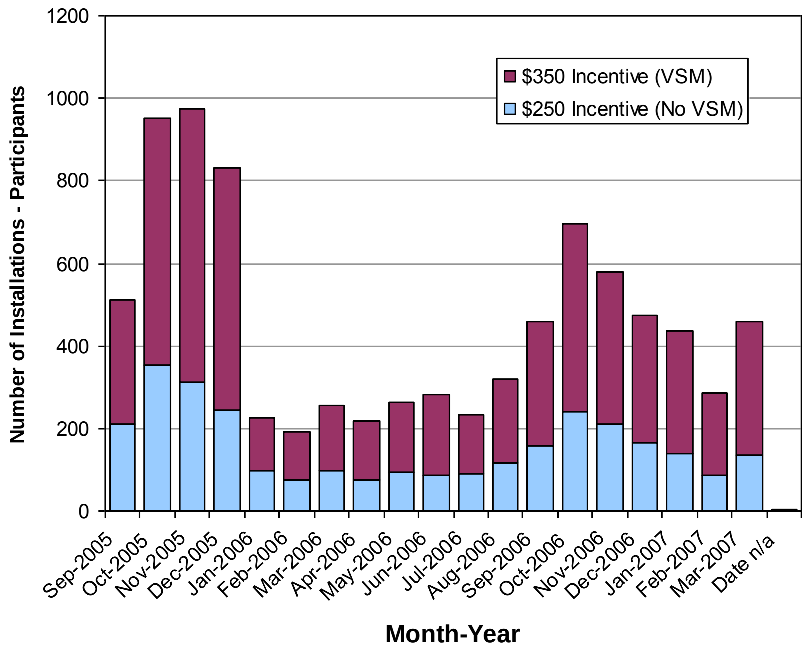
2.4 Program Description and Statistics

Terasen's 2005-07 Heating System Upgrade Program offered a financial incentive of $250 towards the purchase of an Energy Star® qualified high efficiency natural gas furnace or boiler, and an additional $100 incentive if the qualifying furnace / boiler was equipped with a variable speed drive motor

(VSM). Incentives were offered from September 2005 to March 2007. The $250 incentive was funded by Terasen and the British Columbia Ministry of Energy Mines and Petroleum Resources. The VSM incentive was funded by Terasen, Natural Resources Canada (co-funding ceased March 2006), BC Hydro (BC Hydro customers only), and Fortis BC (Fortis BC customers only). The primary objectives of the Heating System Upgrade Program were to reduce the energy consumption and peak demand associated with the existing residential home heating applications, and to reduce harmful greenhouse gas emissions by increasing the energy efficiency of home heating systems. The economic effectiveness of the program depends upon the marginal cost of energy conserved being less than the marginal cost of new supply.

In total, 8,652 households participated in the initiative, with 65% or 5,667 households opting to install a high efficiency furnace equipped with a VSM blower motor. Figure 1 illustrates the monthly program activity in terms of the number of installations per month.

Figure 1: Terasen Heating System Upgrade Program – Installations by Month-Year



2.5 Evaluation Issues, Data Sources, and Methods

The evaluation of the 2005-07 Heating System Upgrade program is being conducted in two phases. The first phase addressed factors influencing program participation, free riders, program-induced changes to furnace and furnace blower operating behaviours, customer and trade ally satisfaction, and preliminary estimates of program savings and reductions in carbon dioxide emissions. The second phase of the evaluation will undertake a billing analysis of participating and non-participating customers to firm up estimates of program savings. This latter phase will commence after study participants have accumulated sufficient billing history (one full heating season) with their new furnace. The phase two evaluation will also use data gathered from the market research conducted under the first phase of the evaluation plan.

Exhibit 3 lists the evaluation objectives for the first and second phases of the evaluation, and identifies the data sources and methods used to satisfy each. Primary data and information for phase one came from telephone surveys conducted with representative samples of program participants (n=100), non-participants (i.e., customer who replaced a furnace but did not participate in Terasen's furnace program) (n=100), and trade allies (i.e., furnace dealers and contractors) (n=50). The surveys were used to estimate a wide range of variables pertaining to program awareness; satisfaction; characteristics of customers, trade allies, furnaces, housing, and the market; furnace prices; and free rider and spillover effects. Each of these estimates have a different level of confidence due to variations in the size of their respective standard errors.

Exhibit 3: Evaluation Issues, Data Sources and Methods

Evaluation Issue	Data Sources	Methods
Phase 1.		
Assess the reasons for program participation, the effectiveness of program marketing / advertising, barriers to participation, and overall customer and trade ally satisfaction with the program.	Participant survey Trade ally survey	Cross tabulations
Assess program impact on sales of qualifying high-efficiency furnaces, and variable speed blower motors (VSM), for both participating and non-participating customers.	Participant survey Non-participant survey Trade ally survey	Cross tabulations
Document and assess program impact on furnace and secondary heating operating behaviours that affect energy use, with particular emphasis on hours of operation.	Participant survey Non-participant survey	Cross tabulations
Determine the status of market transformation for HEFs, and VSMs, in the British Columbia market.	Participant survey Non-participant survey Trade ally survey	Cross tabulations
Develop preliminary estimates of program impact on natural gas sales and carbon dioxide emissions.	Program records Previous research Participant survey	Engineering algorithm Previous billing analysis
Phase 2.		
Determine program impact on natural gas consumption using weather-adjusted billing data	Customer survey Billing records Weather files	Weather-adjusted billing analysis
Calculate estimates of program impact	Billing analysis Customer survey	Engineering algorithm
Determine program impact on carbon dioxide reductions	Billing analysis Terasen assumptions	Engineering algorithm

The participant survey sample was developed using program records. Non-participants were drawn from Terasen's general billing database. Non-participants were eligible to complete a survey if they had replaced their furnace during 2005, 2006, or the first three months of 2007. The survey of trade allies used information on registered contractors that participated in the program. Appendix C provides details on the steps undertaken to prepare the survey samples for each of the three surveys.

2.5.1 Survey Results

The participant (n=100) and non-participant surveys (n=100) were conducted between September 6 to 23, 2007. Results for proportion-based questions are accurate to plus or minus 9.8%, 19 times out of 20.

The trade ally survey (n=50) was conducted between September 10 to 15, 2007. Applying a finite population correction factor, questions yielding sample proportions are accurate within plus or minus 13.3%, 19 times out of 20.

2.6 Phase One Impact Formulae

Analysis of Terasen's impact on high-efficiency furnace sales is based on the following equation (1), where the number of units rebated was obtained from program information and the free rider rate was derived using participant survey information.

(1) Net furnace sales due to program = Units rebated $*$ (1 – free rider rate)

Analysis of program impact on sales of variable speed blower motors (VSM) was calculated using equation (2), where units rebated came from program information and free rider rate is derived from the participant survey.

(2) Net VSM sales due to program = Units rebated $*$ (1 – free rider rate)

Determination of annual energy savings due to the program considered two actions that were taken in response to the incentive: installation of a high-efficiency furnace rather than a standard efficiency furnace, and early replacement of a furnace (spillover).

Determination of program savings, exclusive of any spillover, is determined by equation (3), where units rebated comes from program information and the free rider rate was based on consumer survey information.

(3) Direct Energy Savings = $C_{RF} * (AFUE_{rep} / AFUE_{leg} - AFUE_{rep} / AFUE_{prgm}) * (1 - FR) * \text{Units}$

C_{RF}	- Annual consumption of replaced furnace
$AFUE_{rep}$	- AFUE of replaced furnaces
$AFUE_{leg}$	- Current legislated minimum AFUE for furnaces sold in British Columbia
$AFUE_{prgm}$	- Average AFUE of furnaces rebated by Terasen
FR	- Free riders (proportion of gross participants)
Units	- Number of units rebated

Equation (3) explicitly accounts for the fact that the least efficient furnace available on the market today, has, by law, an AFUE (78%) that is higher than the AFUE of the typical furnace being replaced (~70% to 71%). This means that even without Terasen's program, the vast majority of households replacing their old furnaces would have no choice but to purchase a unit with an AFUE higher than their old furnace. Without this adjustment, energy savings from this incremental improvement in furnace efficiency would be incorrectly attributed to Terasen's Heating System Upgrade Program.

Equation (4) details the determination of spillover (SO) savings based upon information regarding attribution and years of advancement provided from the customer survey.

(4) Spillover Energy Savings = $C_{RF} * (1 - AFUE_{rep} / AFUE_{leg}) * \text{Units} * \text{Years Advanced}$

C_{RF}	- Annual consumption of replaced furnace
$AFUE_{rep}$	- AFUE of replaced furnaces
$AFUE_{leg}$	- Current legislated minimum AFUE for furnaces sold in British Columbia
Years	- Number of years early replacement
Units	- Number of units rebated

Spillover savings are calculated to estimate the additional natural gas that would have been consumed had the conventional furnace been used for the "years advanced" period. They are based on the difference in consumption between the conventional furnace and the legislated level, as the reduction between the legislated level and the high efficiency furnace is captured in Equation (3) above.

Calculating the reduction in carbon dioxide (CO^2) emissions from the energy saved by the program is achieved using equation (5), with the emissions factor supplied by Terasen.

(5) ΔCO_2 = (Direct Energy Savings + Spillover Energy Savings) x EF

ΔCO_2 - Change in CO^2 emissions in tonnes
EF - Emissions factor (tonnes CO^2 per GJ energy)

2.7 Phase Two Billing Analysis

Estimated monthly consumption by calendar month for participants and non-participants will be provided by Terasen. Post-program consumption information will be weather normalized using information on heating degree-days from a suitable regional weather station. This weather normalized data will be augmented with pre-installation weather normalized data. An initial estimate of the difference in pre/post consumption due to the program will be estimated as follows in equation (6).

(6) Change in consumption in gigajoules = change in participant consumption – change in non-participant consumption

Analysis of carbon dioxide emissions is based on the following equation (7) where the emissions factor is provided by Terasen.

(7) Change in carbon dioxide emissions in tonnes = number of participants x b $*$ emissions factor/1000 tonnes

3 Customer Survey Results

The participant (n=100) and non-participant surveys (n=100) were conducted between September 6 to 23, 2007. Results for a typical proportion-style question are accurate within plus or minus 9.8%, 19 times out of 20.

3.1 Customer Characteristics

A series of questions were asked of all survey respondents to understand the demographic make-up of participants and non-participants, and to identify any characteristics that distinguished the two groups of customers from one another other than participation or non-participation in Terasen's Heating System Upgrade Program.

Exhibit 4 summarizes the age profile of participants and non-participants. Compared to participants, non-participants tended to have proportionately fewer homeowners who were in the middle age group (35 to 55 years) and relatively more homeowners aged 55 years of age and older (63%). Indeed, 41% of non-participants were 65 years of age or older, compared to 28% of participants.

Exhibit 4: Age of Respondents

	Total	Participants	Non-Participants
Base (n)	*200*	*100*	*100*
Less than 19 years	-	-	-
19 to 24 years	1%	1%	1%
25 to 34 years	4%	2%	5%
35 to 44 years	12%	13%	11%
45 to 54 years	22%	26%	17%
55 to 64 years	24%	26%	22%
65 years and older	35%	28%	41%
DK/NR	4%	4%	3%
Total	100%	100%	100%
Summary			
34 years and younger	*5%*	*3%*	*6%*
35 to 54 years	*34%*	*39%*	*28%*
55 years and older	*59%*	*54%*	*63%*

Totals may not sum due to rounding
DK/NR = Don't know / no response

The participants were more likely than non-participants to be married or in common-law relationships (81% versus 71% respectively) (Exhibit 5). Non-participants were more likely to be single or widowed, an outcome consistent with the higher proportion of young adults and seniors in this group.

Exhibit 5: Marital Status of Respondents

	Total	Participants	Non-Participants
Base (n)	*200*	*100*	*100*
Single	10%	6%	13%
Married/Common-Law	76%	81%	71%
Divorced/Separated	3%	4%	1%
Widowed	7%	4%	9%
DK/NR	6%	5%	6%
Total	100%	100%	100%

Totals may not sum due to rounding

Participants and non-participant households had an average of 2.7 and 2.8 individuals living at home. The age profiles of household members are presented in Exhibit 6.

Exhibit 6: People in the Household by Age Group

	Total	Participants	Non-Participants
Base (n),***	*175 - 185*	*90 - 94*	*85 - 91*
Less than 19 years	4%	3%	4%
19 to 24 years	35%	32%	38%
25 to 34 years	18%	23%	13%
35 to 44 years	15%	15%	15%
45 to 54 years	20%	15%	25%
55 to 64 years	3%	4%	2%
65 years and older	5%	8%	3%
Total	100%	100%	100%
Average per Household	*2.8*	*2.7*	*2.8*

Totals may not sum due to rounding
** excluding DK/NR*
*** The number of household members by each age category were queried individually. Consequently, the number of DK/NR responses sometimes differed by age group. This, in turn, affected the base (n) counts after removing DK/NR responses.*

The education profile of survey respondents is presented in Exhibit 7. It shows that participants in Terasen's 2005-07 Heating System Upgrade Program are more likely than non-participants to have taken some form of post-secondary education (73% versus 66%).

Exhibit 7: Educational Status of Survey Respondents – Highest Level of Schooling Attained

	Total	Participants	Non-Participants
*Base (n)**	*175*	*90*	*85*
Some high school	7%	6%	9%
Completed high school	23%	21%	25%
Some university/college	13%	11%	14%
Completed university/college	36%	39%	33%
Some trade/technical school	4%	7%	1%
Completed trade/technical school	9%	6%	12%
Post graduate	9%	11%	6%
Total	100%	100%	100%
Summary			
High school or less	30%	27%	34%
Post-secondary	70%	73%	66%

Totals may not sum due to rounding
** excluding DK/NR*

Exhibit 8 presents the income profiles of participant households versus non-participant households rebased to exclude respondents who did not know or declined to answer the question. Consistent with differences observed in the education profile of participants versus non-participants, more than half of all participants (52%) earned more than $80,000 in 2006 compared to less than one third (30%) of all non-participants. On the other end of the income spectrum, non-participants were more likely to earn less than $40,000 a year than participants (30% versus 16%). These results are also consistent with the age profiles of the two respondent groups, with seniors more likely to be living on fixed incomes.

Exhibit 8: Household Income before Taxes

	Total	Participants	Non-Participants
*Base (n)**	*110*	*64*	*46*
Less than $20,000	5%	3%	7%
$20,000 to $39,999	17%	13%	24%
$40,000 to $59,999	24%	20%	28%
$60,000 to $79,999	12%	13%	11%
$80,000 to $99,999	17%	19%	15%
$100,000 to $124,999	12%	13%	11%
Over $125,000	14%	20%	4%
Total	100%	100%	100%
Summary			
Less than $40,000	22%	16%	30%
$40,000 to $79,999	35%	33%	39%
More than $80,000	43%	52%	30%

Totals may not sum due to rounding
** excludes DK/NR*

3.2 Furnace Characteristics

3.2.1 New Furnace

All survey respondents were read descriptions of high efficiency and standard efficiency furnaces, and then were asked to describe the efficiency level of their new furnace. If participants indicated something other than high efficiency, the descriptions were repeated and the question asked again.[1,2] Exhibit 9 shows that despite the effort to clearly communicate the differences between standard and high efficiency furnaces, a small proportion of program participants (6%) still believed they installed a standard efficiency furnace.

Exhibit 9: Efficiency Level of the New Furnace

	Total	Participants	Non-Participants
Base (n)	*200*	*100*	*100*
Standard Efficiency	23%	6%	39%
High Efficiency	71%	93%	48%
DK/NR	7%	1%	13%

Forty-eight percent (48%) of non-participants indicated their new furnace was a high efficiency model, and 39% indicated their furnace was a standard efficiency model. The higher proportion of non-participants versus participants who were unsure of the efficiency of their new furnace (13% versus 1%) suggests that participation in Terasen's program helped educate the consumer on furnace efficiency. The difficulty some respondents, particularly non-participants, had in identifying the efficiency level of their new furnace, was identified during the previous evaluation (Habart 2004). A review of the data on the efficiency level and age of the replaced furnace (discussed in the upcoming Section 3.2.2) suggests that a small proportion of participants and non-participants also incorrectly identified the efficiency level of their old furnace. Given this, readers should use caution when interpreting analyses using self-reported furnace efficiency data.

Depending upon the treatment of non-participants who were unsure of their new furnace's efficiency, the estimate of baseline market share for high efficiency furnaces can range from 48% to 61%. For example, if "unsure" respondents are assumed to have installed standard efficiency furnaces, the market share of high efficiency furnaces remains at 48%. Conversely, if they are assumed to have installed high efficiency furnaces, then the high efficiency share rises to 61% (48% plus 13%). This assumption, however, is likely optimistic. A conservative approach is to proportion the unknown respondents according to the current breakdown between high and standard efficiency provided by non-participants who knew their furnaces' efficiency (48% + 48%/(39%+48%) * 13%). This approach yields an estimate of high efficiency furnace share among participants of 55%.

Participants and non-participants were asked to identify the size of their new furnace in Btu/hour. As the results presented in Exhibit 10.clearly show, the majority of respondents, regardless of participation, were unable to answer this question. Of the small number that did, participants reported an average furnace size of 64,250 Btu/hour and non-participants reported an average of 72,400 Btu/hour. The small number of responses for each group makes these estimates subject to a large standard error, requiring caution in their interpretation and use.

[1] Only high efficiency furnaces were eligible for a rebate from Terasen.

[2] To avoid adding unnecessary complexity to the customer survey, respondents were not required to differentiate between a standard versus a mid-efficiency furnace. Rather, a standard efficiency furnace was defined in the survey as having an AFUE rating of between 55% to 85%, which, by industry-accepted definitions, includes both standard and mid efficiency furnaces. References to standard efficiency furnaces throughout the customer survey and the analysis of the customer survey results, by default, include both standard and mid efficiency furnaces. The traditional definitions of standard, mid, and high efficiency furnaces were used in the trade ally survey.

Exhibit 10: Capacity of New Furnace (Btu/hour)

	Total	Participants	Non-Participants
Base (n)	*200*	*100*	*100*
*Valid (n) ** *	*22**	*12**	*10**
Average	67,955	64,250	72,400
Standard Error	5,361	7,174	8,246
DK/NR	89%	88%	90%

** Caution is advised when comparing responses based on small samples*
*** sample excluding DK/NR responses*

The inability of a large number of respondents to identify the capacity of their new furnace was noted in the evaluation of Terasen's 2003 heating upgrade program (Habart 2004).

All non-participants, and participants that did not receive the $100 VSM incentive were read a description of a variable speed motor and then asked whether their new furnace was equipped with a furnace fan that used a VSM. Exhibit 11 summarizes the findings for participants and non-participants, organized by efficiency level of the furnace. Participants with VSM blowers include all who received the VSM rebate plus those who did not but indicated, through questioning, that they had installed a VSM-equipped furnace.

Exhibit 11: Blower Motor Type by Efficiency of New Furnace
Participants versus Non-Participants

	Participants				Non-Participants			
	Standard Efficiency	High Efficiency	Unknown Efficiency	All Efficiency Levels	Standard Efficiency	High Efficiency	Unknown Efficiency	All Efficiency Levels
Base (n)	*6**	*93*	*1**	*100*	*39*	*48*	*13**	*100*
PSC	17%	9%	-	9%	26%	35%	31%	31%
VSM	83%	82%	-	81%	46%	40%	15%	39%
DK/NR	-	10%	100%	10%	28%	25%	54%	30%
Total	100%	100%	100%	100%	100%	100%	100%	100%

** Caution is advised when comparing responses based on small samples*

In total, 81% of participants surveyed indicated their new furnace is equipped with a VSM. This percentage includes participants who received a $100 VSM incentive (69%) and participants who indicated their new furnace was equipped with a VSM despite not receiving a VSM incentive from Terasen (12%). VSM-equipped furnaces were installed by an estimated 39% of non-participants. Despite providing a description of the two types of furnace blower motors to survey respondents, 10% of participants and 30% of non-participants did not know whether their furnaces were equipped with a PSC or VSM blower motor.

3.2.2 Replaced Furnace

Eighty-eight percent (88%) of participants indicated their old furnace was a standard efficiency unit, 3% said it was a high efficiency unit, and 9% were unsure of the old furnace's efficiency (Exhibit 12). Non-participants reported similar proportions of standard to high efficiency. A significant percentage (17%) of non-participants could not / did not answer the question.

Exhibit 12: Efficiency Level of Old (Replaced) Furnace

	Total	Participants	Non-Participants
Base (n)	*200*	*100*	*100*
Standard Efficiency	83%	88%	78%
High Efficiency	4%	3%	5%
DK/NR	13%	9%	17%

Survey respondents were asked about the age of the furnace replaced, and whether the furnace was working at the time it was replaced. If households that participated in the Terasen rebate program replaced their furnaces at a younger age, and/or prior to the furnace failing, this would be viewed as an indicator of potential spillover. If so, Terasen could be credited with additional savings arising from the early replacement of less efficient furnaces. Exhibit 13 summarizes the findings from the participant and non-participant surveys.

Exhibit 13: Age and Operational Status of Old Furnace at Time of Replacement

	Total	Participants	Non-Participants
Base (n)	*200*	*100*	*100*
Age of furnace at time of replacement	24.4	24.1	24.7
Percent of respondents' furnaces that were working at time of replacement	84%	91%	77%

Ninety-one percent (91%) of participants versus 77% of non-participants indicated their furnaces were working prior to replacing them. Participants and non-participants estimated the average age of their replaced furnace at 24.1 years and 24.7 years on average. These two estimates are not statistically different at the 95% confidence interval.

An analysis of the furnace age data and self-reported efficiency level of replaced furnaces suggests that some households have mistakenly identified their old furnace as high efficiency. For example, three participants reported that their new furnace replaced an existing high efficiency furnace. Two of these furnaces were at least 15 years old when replaced (i.e., one was 15 years old and the other was 27 years old). While it is possible that these participants are correct, high efficiency furnaces represented a very small proportion of the market 15 years ago, and they were just entering the market 27 years ago. The third participant did not know the age of the replaced furnace so an assessment of the correctness of their answer on furnace efficiency was not possible. For non-participants, five reported that their old furnace was a high efficiency unit. However, all but two of these furnaces predated the introduction of high efficiency models.

3.3 Customer Awareness

Forty-eight percent (48%) of Terasen customers who installed a new furnace between January 2005 and March 2007, but did not participate in the furnace rebate program (non-participants), were aware of the rebate program (Exhibit 14). The evaluation of the 2003 program found that only 31% of non-participants were aware of the Terasen Heating System Upgrade Program in effect at that time. There was no statistically significant difference between the age groups of non-participants who were aware versus unaware of the program.

Exhibit 14: Awareness of Furnace Rebate Program among Non-Participants by Age

	Aware	Unaware
*Base (n)**	*48*	*46*
34 years and younger	2%	10%
35 to 54 years	33%	24%
55 years and older	65%	65%
Average	48%	52%

** excludes DK/NR*

Those who participated in the Terasen program (participants) identified four primary sources of their awareness of the program: Terasen bill inserts (mentioned by 29% of participants), furnace contractor (26%), word of mouth (21%), and direct mail from Terasen (15%). Exhibit 15 lists all sources of awareness, ranked by most frequently mentioned to least mentioned.

Exhibit 15: Source of Program Awareness – Participants
Percent of Respondents (Multiple Responses Allowed)

	Percent of all Participants
Base (n)	*100*
Insert in Terasen Gas bill	29%
Through heating or furnace contractor	26%
Word of mouth	21%
Direct mail from Terasen Gas	15%
Terasen Gas website	4%
Newspaper or magazine advertisement	3%
Radio advertisement	3%
TV advertisement	3%
Trade shows and consumer events	2%
Other websites	1%

3.4 Customer Satisfaction

Satisfaction with a series of program and furnace attributes was queried.

3.4.1 Satisfaction with Program Attributes

Exhibit 16 summarizes participants' satisfaction with five different attributes of the rebate program using the average ratings based on a five-point scale, where five represented "very satisfied" and one represented "not at all satisfied". The highest mean score (4.1 out of 5.0) was given to the application procedures to obtain the rebate, while the lowest satisfaction rating (3.7) was given for the amount of the rebate. The standard error of the estimate was 0.1, meaning that differences larger than plus or minus 0.2 in the means are significant at the 95% confidence interval. Satisfaction ratings are generally very favourable, with no apparent program miscues on program information, equipment coverage, or participation procedures.

Exhibit 16: Customer Satisfaction with Various Program Components - Participants
Mean scores using a 5-point satisfaction scale

	Mean Score
Base (n)	*100*
Application procedures to obtain the rebate	4.1
Information on the rebate	4.0
Number or type of furnaces eligible for the rebate	3.9
Information about efficient furnaces	3.9
Amount of the rebate	3.7

See Appendix D for additional detail on this table.

The frequency and nature of calls to a customer call centre about a program can be a useful indicator of potential gaps or confusion in program eligibility, application procedures, or processing times. Slightly more than two of every ten program participants (22%) contacted the Terasen Gas Customer Call Centre about the furnace rebate program. Exhibit 17 lists the reasons for the call based on the frequency of mention. Clarifying their eligibility for receiving the rebate was, by a considerable margin, the reason mentioned by 73% of respondents who called the centre. Determining whether their furnace was eligible for the rebate, and understanding the rebate, were mentioned by 18% of all respondents. The proportion of participants calling Terasen's call centre is not considered excessive.

Exhibit 17: Purpose of Participant's Call to Terasen Gas' Customer Call Centre
Percent of Callers (Multiple Responses Allowed)

	Percent of all Callers
Base (n)	*22**
To clarify my eligibility for the incentive	73%
To determine if the furnace was eligible for the rebate(s)	18%
To understand the rebate	18%
DK/NR	5%

** Caution is advised when comparing responses based on small samples*

3.4.2 Satisfaction with Furnace Attributes

Satisfaction with an energy efficiency program can be strongly influenced by customers' satisfaction with the technology or service for which they received an incentive. In the case of Terasen's furnace rebate program, participants were asked to rate their satisfaction with their choice of furnace. Non-participants were also asked the same question to test for differences related to program participation and furnace efficiency levels.

Exhibit 18 summarizes customers' satisfaction with the choice of furnace, delineated by participants versus non-participants, and those who purchased furnaces with PSC motors versus those who purchased furnaces with variable speed motors (VSMs). Note, both participants and non-participants installed VSM-equipped furnaces.

Overall satisfaction with furnace choice among participants is high, with 86% saying they were either extremely or very satisfied with their choice of furnace. Only 3% said they were not very satisfied or not at all satisfied. Expressed as a mean score using a five point scale (where 5 equals "extremely satisfied" and 1 equals "not at all satisfied"), participants gave their furnaces an average satisfaction score of 4.2 out of 5. By comparison, non-participants gave their furnaces a somewhat lower average score of 4.0 out of 5.0, with fewer non-participants assigning the top score (i.e., extremely satisfied) to their furnace choice.

The proportion of homeowners who were very or extremely satisfied with VSM-equipped furnaces (89%) was significantly higher than those who chose PSC-equipped furnaces (75%), with VSM owners giving an average score of 4.2 out of 5.0 versus 3.9 for PSC owners. The higher satisfaction scores given by households with VSM equipped furnaces appears largely attributable to improvements in home comfort (Section 3.4.3).

Exhibit 18: Customer Satisfaction with Their Choice of Furnace

	Total	Participants	Non-Participants	PSC	VSM	Unknown Blower Motor Type
Base (n)	*200*	*100*	*100*	*40*	*120*	*40*
Extremely Satisfied (5)	29%	38%	20%	15%	36%	23%
Very Satisfied (4)	54%	48%	60%	60%	53%	53%
Somewhat Satisfied (3)	14%	11%	16%	20%	8%	25%
Not Very Satisfied (2)	2%	2%	1%	5%	1%	-
Not at all Satisfied (1)	1%	1%	1%	-	2%	-
DK/NR	1%	0%	2%	-	2%	-
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
Extremely or Very Satisfied	83%	86%	80%	75%	89%	76%
Not Very or Not at all Satisfied	3%	3%	2%	5%	3%	0%
Mean	**4.1**	**4.2**	**4.0**	**3.9**	**4.2**	**4.0**

Totals may not sum due to rounding

Exhibit 19 summarizes the mean satisfaction scores assigned to seven different attributes of the new furnace by participants, non-participants, and participants and non-participants combined. Attributes that received the highest rating from participants included reliability (4.7 out of 5.0), ease of installation (4.4), and after sales service (4.2). Non-participants also rated these the highest, with comparable scores, albeit with slight variations. Participants rated their satisfaction somewhat lower than non-participants for natural gas bill savings, the price of the furnace, and electricity bill savings after installing the furnace. These somewhat lower scores for participants may reflect the higher expectation of energy savings associated with the high efficiency furnaces promoted by Terasen and the trade allies.

Of note, respondents with VSM-equipped furnaces (participants and non-participants) gave significantly lower satisfaction scores to the amount of electricity bill savings compared to those who installed PSC-equipped furnaces. The lower score may be indicative of unmet expectations of electricity savings promised in program literature or through contact with trade allies.

Exhibit 19: Customer Satisfaction with Their New Furnace
Mean Scores using a 5-point Satisfaction Scale

	Total	Participants	Non-Participants	PSC	VSM	Unknown Blower Motor Type
Base (n)	*200*	*100*	*100*	*40*	*120*	*40*
The reliability of your furnace	4.6	4.7	4.5	4.4	4.7	4.6
Ease of installation of your furnace	4.4	4.4	4.4	4.4	4.4	4.3
After sales service for your furnace	4.2	4.2	4.3	4.2	4.2	4.4
Natural gas consumption of your furnace	4.2	4.1	4.2	4.1	4.1	4.2
Amount of your natural gas bill after installing the furnace	4.0	3.9	4.1	3.8	4.0	4.1
The price of your furnace	3.9	3.9	4.0	3.9	3.9	4.1
Amount of your electricity bill after installing the furnace	3.9	3.9	4.0	4.2	3.8	4.1

See Appendix D for additional detail on this table.

The incidence of problems with new furnaces is relatively low with only 8% of survey respondents indicating they have experienced problems (Exhibit 20). The difference in the proportion of participants experiencing problems versus non-participants is not statistically significant.

Exhibit 20: Incidence of Problems with New Furnace

	Total	Participants	Non-Participants	PSC	VSM	Unknown Blower Motor Type
Base (n)	*200*	*100*	*100*	*40*	*120*	*40*
Yes	8%	10%	6%	10%	8%	5%
No	91%	90%	92%	90%	91%	93%
DK/NR	1%	0%	2%	0%	1%	3%
Total	100%	100%	100%	100%	100%	100%

Totals may not sum due to rounding

Those who had experienced problems with their new furnace were asked to elaborate on the nature of the problems. Responses are listed in Exhibit 21. Caution is advised in the interpretation of these results because of relatively few responses.

Exhibit 21: Types of Problems Experienced with New Furnace
Percent of Respondents Experiencing Problems (Multiple Responses Allowed)

	Total	Participants	Non-Participants	PSC	VSM	Unknown Blower Motor Type
Base (n)	*14**	*10**	*4**	*4**	*9**	*2**
Furnace cycles off and on too frequently	36%	30%	50%	50%	33%	-
Furnace has required major repairs	14%	20%	-	-	22%	-
Difficult to maintain the right temperature	29%	20%	50%	50%	22%	-
Furnace is too noisy	29%	20%	50%	25%	22%	100%
Other	14%	20%	-	50%	-	-
DK/NR	1%	0%	2%	0%	1%	3%

** Caution is advised when comparing responses based on small samples*

The relatively small number of issues reported by respondents who installed VSM equipped furnaces suggests that reliability of VSMs has improved over that observed in the previous evaluation (Habart 2004).

3.4.3 House Comfort

Energy-efficient natural gas furnaces are often promoted as improving the comfort of the home. Participants and non-participants were asked whether comfort in the home has increased, decreased or remained the same since the installation of their new furnace. The results are shown in Exhibit 22. Seventy-one percent (71%) of program participants reported that comfort in the home improved after installing their high efficiency furnace, compared to only 42% of non-participants. Non-participants were twice as likely to say their home's comfort remained the same as before the furnace change-out. Homes with VSM-equipped furnaces were significantly more likely than those with PSC-equipped furnaces to experience an increase in home comfort (68% versus 43% respectively). The proportion of survey respondents indicating that comfort had increased after installing their new furnace did not vary significantly by furnace efficiency.

Exhibit 22: Comfort in House after Furnace Replacement

	Total	Participants	Non-Participants	PSC	VSM	Unknown Blower Motor Type
Base (n)	*200*	*100*	*100*	*40*	*120*	*40*
Increased	57%	71%	42%	43%	68%	38%
Decreased	2%	2%	2%	3%	2%	3%
Stayed the Same	38%	25%	50%	48%	30%	50%
DK/NR	4%	2%	6%	8%	1%	10%
Total	100%	100%	100%	100%	100%	100%

Totals may not sum due to rounding

Homeowners who reported an increase in comfort were asked to elaborate on how comfort had improved. Exhibit 23 provides the responses, ranked by frequency of mention. The most commonly mentioned benefit was that temperatures between rooms in the house were now more even (59% of all respondents whose comfort has increased). Participants were more likely than non-participants to have mentioned this benefit (69% versus 43%), although there was no difference between those with PSC- versus VSM-equipped furnaces. The next two most frequently mentioned benefits included a warmer house (22%), and increased comfort (non-specific answer) (21%).

Exhibit 23: How Comfort Level in the House Increased
Percent of Respondents who Indicated Comfort has Improved (Multiple Responses Allowed)

	Total	Participants	Non-Participants	PSC	VSM	Unknown Blower Motor Type
Base (n)	*113*	*71*	*42*	*17**	*81*	*15**
More even temperatures between the rooms	59%	69%	43%	65%	65%	20%
House warmer now	22%	27%	14%	24%	22%	20%
House more comfortable	21%	15%	31%	12%	22%	27%
Indoor air quality has improved	13%	17%	7%	6%	16%	7%
Rooms that were previously cold are warmer	13%	14%	12%	6%	16%	7%
Quiet operation of fan / less noise	12%	17%	5%	6%	15%	7%
DK/NR	3%	1%	5%	0%	1%	13%

** Caution is advised when comparing responses based on small samples*

Those reporting that their homes were less comfortable than before the furnace change complained of cool drafts and increased noise level (Exhibit 24). The one complaint about noise level with VSMs may be related to small duct sizing and the VSM attempting to push more air through the duct that it was designed for.

Exhibit 24: How Comfort Level in the House Decreased
Percent of Respondents Indicating Comfort has Decreased (Multiple Responses Allowed)

	Total	Participants	Non-Participants	PSC	VSM	Unknown Blower Motor Type
Base (n)	*4**	*2**	*2**	*2**	*1**	*1**
Cool drafts	75%	50%	100%	100%	-	100%
Noise level increased	25%	50%	-	-	100%	-

** Caution is advised when comparing responses based on small samples*

3.5 Furnace Operation

Program participants and non-participants were queried as to the use of their furnace fan before and after the installation of their new furnace. How the furnace fan is used affects the cost-effectiveness of furnace model choice, namely the choice of PSC or VSM-equipped high efficiency furnace. A 2004 Energy Centre of Wisconsin study found that VSM-equipped furnaces used about half the electricity of comparable (PSC-equipped) high efficiency furnaces (Pigg 2004). The study also found that electricity savings for VSM-equipped furnaces increased dramatically for households that run their furnace fan all the time, either to improve air circulation or to eliminate room-to-room variations in temperature.

The participant and non-participant surveys queried four primary modes of furnace fan operation:

- **Intermittent Use**– the blower operates only when the furnace or air conditioning is operating for either:
  - Heating
  - Heating and cooling

- **Continuous Use**– the blower operates at low speed through the year, and at higher speeds when delivering heat or cooling.

- **Seasonal Continuous Use** – the blower operates continuously during the heating and/or cooling seasons. Heating period is assumed to be five months. Cooling period is three months.
  - Heating
  - Heating and cooling

- **Intermittent Use Plus Ventilation** – refers to intermittent use for circulation for part of the year.

Survey respondents were read the six behaviours and asked to indicate which best described their use of the furnace fan prior to replacing the furnace. Exhibit 25 summarizes the results for this question.

Exhibit 25: Furnace Fan Behaviour before Furnace Change

	Total	Participants	Non-Participants	PSC	VSM	Unknown Blower Motor Type
Base (n)	*200*	*100*	*100*	40	120	40
Intermittently when providing heat	42%	41%	42%	43%	43%	38%
Continuously during the heating season	18%	17%	18%	28%	16%	13%
Intermittently when providing heat or air conditioning	6%	10%	7%	3%	7%	5%
Continuously during the heating / cooling seasons	8%	5%	6%	3%	9%	8%
Intermittently to also provide ventilation for part of the year	3%	4%	5%	3%	3%	0%
Continuously	4%	3%	3%	5%	4%	0%
No furnace fan (boiler)	5%	2%	2%	13%	3%	3%
DK/NR	18%	18%	17%	5%	16%	35%
Total	100%	100%	100%	100%	100%	100%

Totals may not sum due to rounding

Participants and non-participants were remarkably similar in their furnace fan behaviours prior to replacing their old furnace. The largest use of furnace fans for both groups was to provide heat intermittently (41% and 42% respectively), followed by continuous use during the heating season (17% and 18%). Of note, 18% of participants and 17% of non-participants could not, or chose not to, answer this question (DK/NR).

Respondents were next asked to indicate how they operate their furnace fans since installing their new furnace. The results for this question are summarized in Exhibit 26. Providing heat intermittently remains the most common fan behaviour for both participants and non-participants (36% and 31% respectively), followed by continuously during the heating season (12% and 16%). The proportion of participants who were unable or chose not to answer this question increased to 21% from 18% in the earlier question. The proportion of non-participants who were unable or chose not to answer this question was 21%, up from 17% in the earlier question.

Exhibit 26: Furnace Fan Behaviour after Furnace Change

	Total	Participants	Non-Participants	PSC	VSM	Unknown Blower Motor Type
Base (n)	*200*	*100*	*100*	*40*	*120*	*40*
Intermittently when providing heat	34%	36%	31%	35%	33%	33%
Continuously during the heating season	14%	12%	16%	23%	11%	15%
Intermittently when providing heat or air conditioning	8%	11%	13%	3%	8%	10%
Continuously during the heating / cooling seasons	12%	10%	8%	10%	15%	5%
Intermittently to also provide ventilation for part of the year	5%	8%	5%	5%	6%	3%
Continuously	5%	2%	4%	5%	7%	0%
No furnace fan (boiler)	2%	0%	2%	8%	0%	3%
DK/NR	21%	21%	21%	13%	20%	33%
Total	100%	100%	100%	100%	100%	100%

Totals may not sum due to rounding

Differences in the number of respondents who were unable or chose not to answer questions regarding furnace fan usage before and/or after the furnace change meant that any before and after comparisons are potentially distorted by the lack of an unequal and/or unmatched base of respondents.[3] The datasets were subsequently rebased to include only those respondents who responded to both the before or after questions. Respondents with boilers were also removed from the analysis. Exhibit 27 summarizes the change in percentage shares between the before and after datasets (net change).

Exhibit 27: Net Change in Furnace Fan Behaviour Shares (Percentage Points) Excluding Non-Responses and Respondents with Boilers

	Total	Participants	Non-Participants	PSC	VSM	Unknown Blower Motor Type
Base (n)	*143*	*74*	*69*	*29**	*91*	*23**
Intermittently when providing heat	-11	-9	-13	-7	-11	-17
Continuously during the heating season	-4	-5	-3	-7	-5	4
Intermittently when providing heat or air conditioning	5	9	0	3	3	13
Continuously during the heating / cooling seasons	7	3	12	10	9	-4
Intermittently to also provide ventilation for part of the year	3	0	6	0	3	4
Continuously	1	3	-1	0	1	0

** Caution is advised when comparing responses based on small samples*

The proportion of participants and non-participants reporting intermittent use of their new furnace to provide heat declined (down by 9 percentage points and 13 percentage points for the two groups respectively). The proportion of participants using their fans intermittently to provide heat or air conditioning increased 9 percentage points suggesting that some chose to add air conditioning when they replaced their furnace.[4] Proportionately more non-participants than participants reported an

[3] Some respondents answered the "before" questions but not the "after" questions, or vice versa.

[4] An increase in the proportion of participants using their fans intermittently when providing heat or air conditioning was noted during the evaluation of Terasen's 2003 heating upgrade program (Habart 2004).

increase in continuous operation during the heating and cooling seasons (+12 percentage points versus +3 percentage points). As well, the proportion of non-participants using their furnace to provide ventilation for part of the year increased. The latter result is consistent with the proportion of non-participants who reported purchasing a furnace with a variable speed motor (39%).

Use of Furnace Fans to Provide Ventilation

Respondents who indicated they operated their fan intermittently to provide ventilation for part of the year were asked to indicate how many months in a given year they operated their fan this way. Unfortunately, there were an insufficient number of responses by both participants (n=2) and non-participants (n=4) in the pre-installation scenario to report results. In the post-installation case, eight non-participants were able to estimate the number of months (4.3 months per year on average). The two participants who ran their furnaces in this manner could not, or chose not to, provide an estimate of the number of months.

Changes to Thermostat Setting

Participants were queried about their thermostat settings pre- and post-installation of their new furnace to understand whether they offset part of their energy savings by keeping the house warmer. If this hypothesis is correct, estimates of energy savings attributable to participants of the Terasen program would be lower than expected.

Exhibit 28 shows that only 4% of participants and 11% of non-participants have adjusted their thermostat to keep their house warmer in the winter months compared to before the furnace change-out. Interestingly, a significantly greater proportion of participants than non-participants reported turning down the thermostat in the winter months since replacing their furnace (22% versus 9%).

Exhibit 28: Change in Thermostat Setting since Furnace Change - Winter Months Only

	Total	Participants	Non-Participants	PSC	VSM	Unknown Blower Motor Type
Base (n)	*200*	*100*	*100*	*40*	*120*	*40*
Warmer	8%	4%	11%	5%	8%	10%
Cooler	16%	22%	9%	13%	19%	8%
Same	69%	67%	70%	68%	69%	68%
Too soon to know	3%	3%	2%	0%	3%	3%
DK/NR	6%	4%	8%	15%	1%	13%
Total	100%	100%	100%	100%	100%	100%

Totals may not sum due to rounding

Respondents who changed their thermostat setting (either direction) were asked how many degrees warmer or cooler they were keeping their house since the furnace change. The average increase in temperature (in degrees Celsius) and the average decrease in temperature, and those reporting no change (i.e., an average change of 0 degrees Celsius) were first calculated and then weighted to derive a net change in the temperature for participants and non-participants. The relative proportion of respondents that responded to the three response categories, rebased to exclude “too soon to know” and DK/NR responses, were used as the weights. The results are summarized in Exhibit 29.

Exhibit 29: Average Degree (Celsius) Change in Thermostat Setting since Furnace Change Winter Months Only

	Participants			Non-Participants		
	Average Degree Change	Weight	Weighted Degree Change	Average Degree Change	Weight	Weighted Degree Change
Base (n)	*93*	*93*	*93*	*90*	*90*	*90*
Degrees Warmer	4.7	0.04	0.2	5.0	0.12	0.6
Degrees Cooler	-3.3	0.24	-0.8	2.5	0.10	-0.2
No Change	0.0	0.72	0.0	0	0.78	0.0
Net Change	-	-	-0.6	-	-	0.4

Totals and multiplicative results may differ due to rounding

The net change in indoor temperature for participants was minus 0.6 degrees Celsius compared to plus 0.4 degrees for non-participants. In effect, participants are keeping their homes a full degree cooler than their non-participant counterparts.

Other Changes to Furnace Settings

Other than changes to the thermostat setting, survey respondents were asked whether they had changed any of the furnace operating settings since installing the furnace. Only 5% of participants and 1% of non-participants reported changing one or more operating settings (Exhibit 30).

Exhibit 30: Change Any Other Furnace Operating Setting since Furnace Replacement

	Total	Participants	Non-Participants	PSC	VSM	Unknown Blower Motor Type
Base (n)	*200*	*100*	*100*	*40*	*120*	*40*
Yes	3%	5%	1%	-	4%	3%
No	95%	94%	96%	100%	94%	93%
DK/NR	2%	1%	3%	-	2%	5%
Total	100%	100%	100%	100%	100%	100%

Totals may not sum due to rounding

When asked to elaborate on what settings were changed, participants mentioned changing the furnace to run less frequently, resetting the blower, installing a digital readout, and installing air conditioning. The sole non-participant that answered yes to this question, reported adjusting the timing of the second stage burner so that it engaged sooner.

3.5.1 Factors Influencing Decision to Purchase a VSM Equipped Furnace

Respondents identified as having a VSM-equipped furnace were asked why they chose a model with a VSM blower. Their answers are summarized in Exhibit 31.

Energy efficiency and the contractor’s recommendation were mentioned by significantly more respondents than any of the other possible factors (44% and 38% of respondents with VSM-equipped furnaces). Eleven percent (11%) of participants mentioned the $100 rebate as a motivating factor in their decision.

Exhibit 31: Reasons for Choosing a VSM-Equipped Furnace
Percent of Respondents with VSMs – Multiple Responses Allowed

	Total	Participants	Non-Participants
Base (n)	*99*	*71*	*28**
It is more energy-efficient	44%	42%	50%
The contractor recommended it	38%	35%	46%
I was motivated by the $100 rebate	9%	11%	4%
It provides even heat	7%	10%	0%
It can operate through a range of speeds	6%	6%	7%
It is quieter	5%	6%	4%
I wanted to have continuous ventilation	5%	4%	7%
It provides more comfortable ventilation	4%	4%	4%
Part of the better furnace I wanted	3%	4%	0%
It keeps my house warmer	2%	1%	4%
I wanted better indoor air quality	1%	1%	0%
DK/NR	23%	20%	32%

** Caution is advised when comparing responses based on small samples*

Twenty-one percent (21%) of participants in Terasen's furnace rebate program who knew their furnace blower type were aware of variable speed blower motors prior to purchasing their VSM-equipped furnace, and another 12% were considering purchasing a VSM-equipped furnace (Exhibit 32). The 10% of participants and 30% of non-participants who were unsure whether their furnace had a VSM were excluded from this question.

Exhibit 32: Aware of or Considering the Purchase of a Furnace with a VSM Prior to Installing Furnace?
Asked of Respondents Who Knew their Furnace Blower Motor Type

	Total	Participants	Non-Participants
*Base (n)**	*160*	*90*	*70*
Aware of	19%	21%	17%
Considering Purchase	9%	12%	6%
No	64%	60%	70%
DK/NR	7%	7%	7%
Total	100%	100%	100%

Totals may not sum due to rounding
** excludes households who did not know whether their furnace was equipped with a VSM*

Respondents who were aware of or considering purchasing a VSM-equipped furnace were asked to identify the source of their awareness. Participants were more likely to credit Terasen (39% of all responses) and the contractor (29%) as their top two sources of awareness (Exhibit 33). Non-participants were more likely to identify their contractor as the top source (38%), followed by Terasen (19%) and the Internet (19%). Seven percent of participants identified past experience with VSMs (e.g., installed in a previous residence).

Exhibit 33: Source of Awareness of Variable Speed Furnace Motors
Percent of Respondents Aware of VSMs – Multiple Responses Allowed

	Total	Participants	Non-Participants
Base (n)	*46*	*30*	*16**
Contractor	30%	27%	38%
Terasen Gas	30%	37%	19%
BC Hydro	2%	3%	0%
Power Smart	2%	0%	6%
Friend(s)	4%	3%	6%
Internet	9%	3%	19%
Previous experience	4%	7%	-
Read article(s)	2%	3%	-
Researched various sources	4%	7%	-
Through work	4%	3%	6%
Other	2%	-	6%

** Caution is advised when comparing responses based on small samples*

Reasons why participants and non-participants did not select a VSM-equipped furnace are summarized in Exhibit 34. Overwhelmingly, both groups of households were simply unaware of the product (96% of all responses). Only 2% of respondents said they were too expensive.

Exhibit 34: Reasons Why a Furnace with a VSM not Chosen
Respondents Who Installed a PSC Equipped Furnace – Multiple Responses Allowed

	Total	Participants	Non-Participants
Base (n)	*103*	*56*	*51*
Unaware of variable speed motors	96%	96%	96%
Too expensive	2%	-	4%
VSM not an option on the furnace chosen	1%	2%	-
DK/NR	1%	2%	-
Total	100%	100%	100%

Totals may not sum due to rounding

3.6 Program Design

Survey respondents were asked to rate the relative importance of various home heating attributes in their choice of furnace using a five point scale where five meant “very important” and one meant “not at all important”. Exhibit 35 summarizes the mean scores for six different attributes. Participants rated energy efficiency as the most important attribute, scoring an average of 4.5 out of 5. Next most important was home comfort (4.3) and operating cost (4.2). Non-participants gave equal scores to energy efficiency, home comfort, and indoor air quality (4.3 for all three). The lower average score assigned to the initial cost of the system by participants (3.8) versus non-participants (4.1) is consistent with the larger proportion of lower income households that make up the non-participant group. First cost (i.e., purchase and installation costs) is a common barrier for lower income households targeted by energy efficiency programming.

Exhibit 35: Attributes that Influenced Choice of Home Heating System (Mean of the 5-point scale)

	Total	Participants	Non-Participants
Base (n)	*200*	*100*	*100*
Energy efficiency	4.4	4.5	4.3
Comfort in your home	4.3	4.3	4.3
Indoor air quality	4.2	4.1	4.3
Operating cost of the system (ie: fuel cost)	4.2	4.2	4.2
Both initial cost and operating costs	4.1	4.0	4.1
Initial cost of the system	4.0	3.8	4.1

See Appendix D for additional detail on this table.

The proportion of participants in Terasen's rebate program who said they were familiar with the Energy Star label for natural gas furnaces was significantly higher than non-participants (82% versus 54%) (Exhibit 36).

Exhibit 36: Familiar with Energy Star Label for Natural Gas Furnaces?

	Total	Participants	Non-Participants
Base (n)	*200*	*100*	*100*
Yes	68%	82%	54%
No	28%	17%	38%
DK/NR	5%	1%	8%
Total	100%	100%	100%

Totals may not sum due to rounding

Of those who said they were familiar with Energy Star, significantly more participants than non-participants recalled seeing the Energy Star label on their furnace or furnace brochure (83% versus 44%) (Exhibit 37). This is consistent with the current 90% AFUE threshold for Energy Star qualified furnaces.

Exhibit 37: Recall Energy Star Label on Furnace or Furnace Brochure?

	Total	Participants	Non-Participants
Base (n)	*136*	*82*	*54*
Yes	68%	83%	44%
No	10%	2%	20%
DK/NR	23%	15%	35%
Total	100%	100%	100%

Totals may not sum due to rounding

When asked to rate the importance of Terasen's incentive program including Energy Star qualified furnaces on a five point scale, where five represented "very important" and one represented "not important at all", 89% of program participants aware of the Energy Star label felt it was important (4 or 5 on the five point scale). Alternatively stated, respondents gave a mean importance rating of 4.5 out of 5.0 (Exhibit 38).

Exhibit 38: Importance of Terasen Incentive Program Including Energy Star Products Five Point Scale Where 1 Represents "Not at all Important" and 5 is "Very Important"

	Participants
Base (n)	*82*
Important (4 or 5)	89%
Not Important (1 or 2)	1%
DK/NR	2%
Mean	4.5

3.7 Furnace Prices

Exhibit 39 summarizes the information provided by survey respondents on the installed cost of their new furnace. These figures represent the sum of the cost of the furnace, contractor mark-up, installation charges, and any applicable taxes and permits. The mean installed cost of the new furnace reported by participants was $3,666, 43% higher than the average $2,567 reported by non-participants. The most commonly reported cost among participants was $3,500 (20% of all participant responses excluding DK/NR) versus $3,000 for non-participants (37% of all non-participant responses excluding DK/NR). PSC-equipped furnaces were less expensive than VSM-equipped furnaces ($2,620 versus $3,493 respectively). The average cost of VSM equipped furnaces installed by participants was $3,740 (not shown), significantly higher than the $2,786 average (not shown) paid by non-participants who installed VSM equipped furnaces. This difference may be due to the incidence of mid-efficiency furnaces sold to non-participants, and possible confusion among non-participants regarding the furnace motor type (i.e., confusing a PSC with a VSM). The price premium for VSM-equipped furnaces may also reflect the presence of other features including two stage burners and better heat exchangers.

Exhibit 39: Installed Furnace Prices ($) Including Taxes

	Total	Participants	Non-Participants	PSC	VSM	Unknown Blower Motor Type
Base (n)	*200*	*100*	*100*	40	120	40
*Valid (n)**	*139*	*74*	*65*	30**	81	28**
Price Ranges						
$999 or less	6%	4%	8%	3%	5%	11%
$1,000 - $1999	5%	1%	9%	13%	4%	0%
$2,000 - $2,999	20%	11%	31%	27%	12%	36%
$3,000 - $3,999	43%	41%	46%	53%	38%	46%
$4,000 - $4,999	17%	26%	6%	3%	27%	0%
$5,000 and over	9%	18%	0%	0%	14%	7%
Total	100%	100%	100%	100%	100%	100%
Mean Prices						
Mean Prices	*$3,152*	*$3,666*	*$2,567*	$2,620	$3,493	$2,738
Std. Error	$94	$122	$105	$157	$122	$190

** Excludes DK/NR*
*** Caution is advised when comparing responses based on small samples*
Totals may not sum due to rounding

The mean installed cost of furnaces reported by respondents unaware of their furnace blower motor type ($2,738) suggests that the majority of these were likely standard efficiency furnaces. Twenty-six percent (26%) of participants and 35% of non-participants were unable to recall the cost, or chose not to answer the question.

The evaluation of Terasen's 2003 heating upgrade program found that participants paid an average of \$3,727. This average cost is not statistically different than the \$3,666 recorded in 2007.[5]

Additional detail about installed furnace costs are provided in Exhibit 40. Non-participant costs were delineated by their self-reported furnace efficiency (standard or high efficiency). The average installed cost for high efficiency furnaces purchased by non-participants was \$2,665, higher than the average for standard efficiency furnaces (\$2,370), but less than the participant average (\$3,666). The higher average costs for participant versus non-participant high efficiency furnaces reflects the larger percentage of participant furnaces that were equipped with VSMs (81% versus 40%). The lower average cost for non-participant high efficiency furnaces may also be due to some non-participant households confusing a mid-or standard efficiency furnace for a high efficiency furnace, despite being provided with verbal descriptions of each during the survey. Trade allies reported that the installed cost of high efficiency furnace was approximately \$700 more than a standard or mid-efficiency furnace (Section 4.10).

Exhibit 40: Mean Installed Furnace Prices (\$) Including Taxes by Efficiency Level

		Participants	Non-Participants		
	Total	High Efficiency	Standard Efficiency	High Efficiency	Unknown Efficiency
Base (n)	*200*	*100*	*48*	*39*	*13**
*Valid (n)***	*139*	*74*	*25*	*34*	*6*
Price Ranges					
\$999 or less	6%	4%	20%	0%	0%
\$1,000 - \$1999	5%	1%	12%	9%	0%
\$2,000 - \$2,999	20%	11%	24%	35%	33%
\$3,000 - \$3,999	43%	41%	36%	50%	67%
\$4,000 - \$4,999	17%	26%	8%	6%	0%
\$5,000 and over	9%	18%	20%	0%	0%
Total	100%	100%	12%	9%	0%
Mean Prices					
Mean	*\$3,152*	*\$3,666*	*\$2,370*	*\$2,665*	*\$2,833*
Std. Error	\$94	\$122	\$206	\$124	\$223

** Excludes DK/NR*
Totals may not sum due to rounding

3.8 Housing Characteristics

The housing characteristics of participants and non-participants are summarized in the next three exhibits. Exhibit 41 provides a breakdown of survey respondents by dwelling type. The data show that the two groups were similar in their dwelling types.

[5] Based on a 95% confidence level and standard errors of \$125 for the 2003 estimate (Habart 2004) and \$122 for the 2007 estimate.

Exhibit 41: Dwelling Type

	Total	Participants	Non-Participants
Base (n)	*200*	*100*	*100*
Single detached	93%	96%	89%
Semi-detached	2%	1%	2%
Apartment/condominium	1%	-	1%
Row/townhouse	2%	1%	2%
Mobile home or other	2%	-	4%
DK/NR	2%	2%	2%
Total	100%	100%	100%

Totals may not sum due to rounding

Exhibit 42 summarizes participant and non-participant dwellings by age. Of note, non-participants were significantly more likely than participants to live in structures built between 26 and 50 years ago. A relatively larger proportion of participants tended to live in homes aged 16 to 25 years.

Exhibit 42: Dwelling Age

	Total	Participants	Non-Participants
Base (n)	*200*	*100*	*100*
15 years or younger	12%	14%	10%
16 to 25 years	19%	24%	14%
26 to 50 years	64%	57%	70%
51 to 75 years	9%	11%	7%
76 years or older	4%	6%	3%
DK/NR	4%	2%	5%
Total	100%	100%	100%
Average Age (Years)	*35.6*	*36.1*	*35.1*

Totals may not sum due to rounding

The slightly larger proportion of non-participants living in single detached properties is consistent with the relatively larger heated floor space of non-participants (2,808 square feet) versus participants (2,494 square feet) (Exhibit 43).

Exhibit 43: Dwelling Size
Heated Floor Space in Square Feet

	Total	Participants	Non-Participants
*Base (n)**	*172*	*86*	*86*
Average (Square Feet)	2,651	2,494	2,808

** Excludes outliers and DK/NR*

The incidence of natural gas end use appliances in participant and non-participant homes is summarized in Exhibit 44.

Exhibit 44: Natural Gas End Uses in the Home
Percent of Respondents (Multiple Responses Allowed)

	Total	Participants	Non-Participants
Base (n)	*200*	*100*	*100*
Water heating	78%	81%	75%
Main space heating	51%	55%	46%
Fireplace insert	39%	41%	37%
Cooking	18%	19%	17%
Barbeque	16%	19%	12%
Secondary space heating	12%	11%	13%
Clothes drying	8%	7%	9%
Hot tub	4%	2%	5%
Patio heater	2%	2%	1%
Indoor pool heating	1%	1%	1%
Outdoor pool heating	1%	1%	-
DK/NR	2%	3%	-

Water heating and main space heating represent the two most common natural gas end-uses in the home. The incidence of natural gas used in main and secondary heating is surprisingly low. It may be that some households, despite having a natural gas fired furnace, use other source of heating as their main source (e.g., wood stove, heat pump, etc.). Some respondents may also have assumed that the interviewer already knew they had a natural gas fired furnace or boiler and, therefore, was asking about end uses other than the furnace or boiler.

3.9 Supplementary Heating

Exploring changes in supplementary heating in participant homes and non-participant homes is important for understanding its possible influence on energy savings attributable to the program. First, households were asked to identify whether they had a source of supplementary heating in the home. If they answered in the affirmative, they were asked to identify the fuel(s) used for the supplementary heating (e.g., electricity, natural gas, etc.), and the method of supplemental heating (e.g., portable electric heater, wood stove, etc.).

Forty-four percent (44%) of respondents affirmed that they had supplementary heating in the home (Exhibit 45). Participants were somewhat more likely than non-participants to have a supplementary heat source (48% versus 40%).

Exhibit 45: Presence of Supplementary Heating

	Total	Participants	Non-Participants	PSC	VSM	Unknown Blower Motor Type
Base (n)	*200*	*100*	*100*	*40*	*120*	*40*
Yes	44%	48%	40%	50%	42%	45%
No	55%	50%	59%	50%	57%	53%
DK/NR	2%	2%	1%	-	2%	3%
Total	100%	100%	100%	100%	100%	100%

Totals may not sum due to rounding

The next two exhibits summarize the fuel used for supplementary heating and the types of supplemental heating used. An initial review of the datasets revealed some inconsistencies. For example, some respondents indicated they had a wood stove but did not mention wood as a fuel source in the earlier question. A similar issue was identified for electricity (e.g., had an electric space heater or electric baseboard heat but did not identify electricity as a fuel source). In light of this, data for electricity and wood supplemental fuels were recoded. If a respondent indicated they had an electric appliance of any sort (e.g., electric space heater, electric baseboard heaters, etc.) they were assumed to have electricity as a fuel source. A similar procedure was taken for wood stoves. In the end, natural gas was the most frequently mentioned fuel used for supplementary heating (42% of all respondents with supplemental heat), followed by electricity (38%) and wood (27%) (Exhibit 46).

Exhibit 46: Fuel Used for Supplementary Heating
Percent of Respondents with Supplementary Heating - Multiple Responses Allowed

	Total	Participants	Non-Participants	PSC	VSM	Unknown Blower Motor Type
Base (n)	*88*	*48*	*40*	*20**	*50*	*18**
Natural Gas	42%	44%	40%	40%	40%	50%
Electricity	38%	38%	38%	35%	42%	28%
Wood	27%	29%	25%	35%	26%	22%
Oil	1%	-	3%	-	2%	-
DK/NR	2%	4%	-	-	4%	-

** Caution is advised when comparing responses based on small samples*

Consistent with the fuel sources identified, respondents identified having a fireplace as the most common supplementary heating method (61% of all respondents with supplemental heat) (Exhibit 47). Electric baseboard heating and portable electric heaters were the next two most common methods, capturing 17% and 9% of mentions by respondents respectively.

Exhibit 47: Types of Supplementary Heating
Percent of Respondents with Supplementary Heating - Multiple Responses Allowed

	Total	Participants	Non-Participants
Base (n)	*88*	*48*	*40*
Fireplace	61%	63%	60%
Electric baseboard heaters	17%	13%	23%
Portable electric heaters	9%	10%	8%
Wood stove	6%	8%	3%
Heat pump	2%	2%	3%
Hot water radiant floor heating	2%	2%	3%
Central forced air furnace	1%	-	3%
Other	1%	2%	-
DK/NR	3%	4%	3%

3.10 Free Riders

Free riders are defined as those households that participated in the Terasen Heating System Rebate program, but would have purchased a high efficiency furnace or boiler even if the incentive had not been available. The energy savings attributable to free riders are excluded from the final determination of program effect.

To assess the degree of free riders, participants were asked to rate the importance of the Terasen financial incentive in their decision to purchase a high efficiency furnace or boiler using a scale of one to five where one meant “not at all important” and five meant “very important”. The results are summarized in Exhibit 48. To determine the importance of the program, a weighted average of the importance scores was calculated. The weights were selected to give the most weight to those indicating the incentive was very important (weight of 1.0) and the least weight to those who indicated it was not at all important (weight of 0). The weighted average of the importance scores was 0.57, meaning the free rider rate is 43% (calculated as 1 - Weighted Average Score).

Exhibit 48: Calculation of Free Riders – Influence of Overall Incentive on Participants

	Very Important (5)	(4)	(3)	(2)	Not at all Important (1)	DK/NR	Total	Free Rider Rate
Distribution of Responses (n=100)	26%	27%	17%	10%	13%	7%	100%	-
Weight	1	.75	.50	.25	0	0	-	-
Product	0.26	0.20	0.09	0.03	0.00	0.00	0.57	**0.43**

A similar weighting scheme was used with the importance ratings given to the role of the $100 incentive in the choice of a furnace with a variable speed blower motor (Exhibit 49). The free rider rate in this case was 43%, as well.

Exhibit 49: Influence of the VSM Incentive on Participant’s Choice of a VSM-equipped Furnace

	Very Important (5)	(4)	(3)	(2)	Not at all Important (1)	DK/NR	Total	Free Rider Rate
Distribution of Responses (n=69)	26%	26%	16%	13%	7%	12%	100%	-
Weight	1	.75	.5	.25	0	0	-	-
Product	0.26	0.20	0.08	0.03	0.00	0.00	0.57	**0.43**

3.11 Spillover

Exhibit 50 summarizes the spillover analysis conducted using participant survey data. Spillover refers to the early replacement of a standard or conventional furnace with an energy-efficient model due the influence of the Terasen heating upgrade program. Thirty percent (30%) of participants credited the Terasen program with advancing their decision to replace their furnace. The average advancement was estimated at 2.3 years.

Exhibit 50: Spillover Analysis - Participants (Multiple Responses Allowed)

	Participants	Average Early Replacement (Years)
Base (n)	*100*	*23**
Yes	30%	2.3
No	67%	-
DK/NR	3%	-
Total (All Participants)	100%	-

** Excludes DK/NR*
Totals may not sum due to rounding

3.12 Barriers to Participation

Non-participants were asked why they did not participate in the Terasen program. Their responses are summarized in Exhibit 51. By far, the single most common reason was a simple lack of awareness of the program (52% of all non-participants). The next most commonly mentioned reasons included not worth the effort / didn't want to bother (19%), rebate was too small (19%), and furnace did not qualify (17%). Ten percent (10%) said they had submitted a rebate application but were rejected.

Exhibit 51: Reasons for Not Participating in Terasen's Heating Upgrade Program Percent of Non-Participants - Multiple Responses Allowed

	Percent of Non-Participants
Base (n)	*100*
Unaware of program	52%
Not worth the effort / Didn't want to bother	19%
Rebate too small	19%
Furnace did not qualify for rebate	17%
Tried to - rebate application was rejected	10%
Didn't know how to apply	8%
Had planned to / didn't get around to it	6%
Contractor was not registered with program	6%
Other	6%
DK/NR	13%

Totals may not sum due to rounding

4 Trade Ally Survey Results

A sample of 50 furnace dealers, contractors, and gas fitters (trade allies) were surveyed between September 10th and 15th, 2007. Trade allies were selected at random from Terasen's list of qualifying furnace contractors. Including a finite population correction factor, questions yielding sample proportions are accurate within plus or minus 13.3%, 19 times out of 20.

4.1 Trade Ally Characteristics

Exhibit 52 presents the distribution of trade ally respondents by the number of employees in their firm. This measure is used as a proxy for firm size. The vast majority (82%) of respondents worked for firms of ten employees or less, with 16% (not shown) of respondents being owner/operators (single person firms).

Exhibit 52: Distribution of Trade Ally Respondents by Firm Size (Number of Employees)

	Percent of Trade Allies
Base (n)	*50*
1 to 2	30%
3 to 5	28%
6 to 10	24%
11 to 15	10%
16 to 20	4%
Over 20	4%
Total	100%
Mean	*6.9*

Totals may not sum due to rounding

Consistent with the significant proportion of single person firms participating in the survey, 26% of respondents categorized themselves as independent heating contractors. Another 18% of trade allies described themselves as furnace dealers and heating contractors. Only 4% of respondents described themselves as gas fitters. Almost half of trade allies (46%) indicated their business was best described by all three categories – dealer, heating contractor, and gas fitter.

Exhibit 53: How Trade Allies Described Their Business

	Percent of Trade Allies
Base (n)	*50*
Furnace Dealer and Heating Contractor	18%
Independent Heating Contractor	26%
Gas fitter	4%
All of the Above	46%
Other	6%
Total	100%

Totals may not sum due to rounding

An analysis of Terasen's program records revealed that 25% of the 665 contractors participating in the program installed 85% of all the rebated furnaces (Exhibit 54). One contractor was responsible for more than 400 installations.

Exhibit 54: Distribution of Trade Allies by the Number of Rebated Furnaces Installed

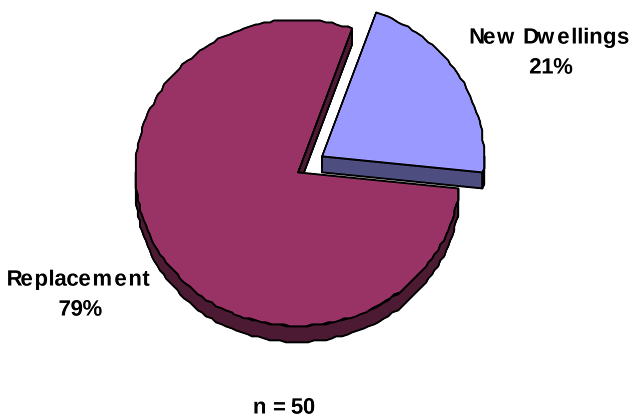
Number of Installations	Percent of All Participating Trade Allies	Percent of All Furnaces Rebated
Base	*665*	*8,652*
1 to 10	15%	75%
11 to 50	31%	18%
51 to 100	28%	5%
101 to 200	21%	2%
> 200	5%	0.2%
Total	100%	100%

Source: Terasen program records

4.2 Market Characteristics

Trade allies estimated that, on average, 79% of their furnace sales / installations were to replace existing furnaces (Figure 2). However this data does not mean that new construction has 21% of the new furnace market. In BC there are a number of firms that only install in new construction, and they are not included in the trade ally survey.

Figure 2: Share of Residential Furnace Sales / Installations: Replacement versus New Dwellings



Trade allies were asked to estimate the percentage of all furnaces sold or installed before, during, and after the Teresan rebate program that were high efficiency. The results, summarized in Exhibit 55, show that the proportion increased from 48% to 65% during the program period before declining to 56% after the end of the program (as indicated in the September 2007 survey).

Exhibit 55: Composition of Replacement Furnace Sales / Installations by Furnace Type Mean Percentages

	Percent High Efficiency	Percent VSM
Base (n)	*50*	*50*
Before Program	48%	34%
During Program	65%	56%
After Program	56%	44%
DK/NR	8%	8%

Trade allies reported that the proportion of furnace sales/installations equipped with variable speed blower motors also increased during the program period, rising from 34% to 56% before declining to 44% as of September 2007.

4.3 Trade Ally Satisfaction

Trade allies were asked to rate their satisfaction with four aspects of Terasen's furnace rebate program using a five point scale, where one represented "not at all satisfied" and five represented "very satisfied". Exhibit 56 summarizes the mean scores. Responses were generally very favourable. The highest satisfaction score was given to the types or numbers of furnaces eligible for the rebate (mean satisfaction score of 4.2). The amount of the rebate received the lowest mean score (3.6).

Exhibit 56: Trade Ally Satisfaction with Various Aspects of the Terasen Rebate Program Mean of the 5-point Satisfaction Scale

	Mean Score
*Base (n)**	*46 - 49*
Types or numbers of furnaces eligible for the rebate	4.2
Application procedures to obtain the rebate	4.1
Information on the rebate	3.8
Amount of the rebate	3.6

** base varies by aspect due to varying numbers of DK/NR responses*
See Appendix D for additional detail on this table.

Fifty-eight percent (58%) of trade allies felt the Terasen rebate was either very or somewhat important in the choice of a high efficiency furnace when asked to rate the importance using a five point scale, where five represented "very important" and one represented "not at all important" (Exhibit 57). Averaged across all valid responses, trade allies gave the rebate a mean score of 3.7 out of 5.0.

Exhibit 57: Importance of the Rebate in Furnace Choice

	Percent of Trade Allies
Base (n)	*50*
Important (4 or 5)	58%
Not Important (1 or 2)	18%
DK/NR	4%
Mean	3.7

Trade allies assigned somewhat less importance to the role of the $100 VSM rebate in their customers' choice of furnace blower motor efficiency (Exhibit 58). Forty-six percent (46%) felt the rebate was either very or somewhat important in the decision to acquire a VSM-equipped furnace. Averaged across all valid responses, trade allies gave the VSM rebate a mean score of 3.2 out of 5.0.

Exhibit 58: Importance of the VSM Rebate in the Choice of a VSM-equipped Furnace

	Percent of Trade Allies
Base (n)	*50*
Important (4 or 5)	46%
Not Important (1 or 2)	34%
DK/NR	2%
Mean	3.2

Sixty-four percent (64%) of trade allies unequivocally felt that high efficiency furnaces were the best choice for their customer (Exhibit 59). Another 22% qualified their responses by saying that it depended upon the customer.

Exhibit 59: Are High Efficiency Furnaces the Best Choice for Customers?

	Percent of Trade Allies
Base (n)	*50*
Yes	64%
No	14%
Sometimes / Depends upon the customer	22%

Exhibit 60 summarizes the reasons, by frequency of mention, why trade allies believe high efficiency furnaces are the best choice for their customers. The most frequently mentioned reason was they save money / are more cost effective (mentioned by 56% of trade allies answering in the affirmative). The next most frequently mentioned reason was that they are more environmentally friendly (26%). Trade allies that said they only sometimes believe a high efficiency furnace is the best choice for the customer or that it depends on the customer were most likely to mention structural constraints present (or not present) in the home as a factor and/or that homeowners found high efficiency furnaces too expensive (data subset not shown)

Exhibit 60: Why Trade Allies Believe High Efficiency Furnaces Are the Best Choice for Customers
Percent of Respondents (Multiple Responses Allowed)

	Percent of Respondents
Base (n)	*43*
Saves money / more cost effective	56%
More environmentally friendly	26%
Structural constraints in home (flue location, electrical panel access)	16%
More energy-efficient	14%
Too expensive for some households	7%
Runs quieter	5%
Provides more even heat	5%
More reliable	2%
Recommend heat pumps / heat pumps more efficient	2%
Other	14%

Totals may not sum due to rounding

Reasons why 14% of trade allies do not believe high efficiency furnaces are the best choice for customers are summarized, by frequency of mention, in Exhibit 61. The most frequently mentioned reason was the preference given to heat pumps (mentioned by 57% of all trade allies who do not recommend high efficiency furnaces). Less frequently mentioned reasons were the expense (14%) and structural issues (14%).

Exhibit 61: Reasons Why Trade Allies Do Not Recommend High Efficiency Furnaces
Percent of Respondents (Multiple Responses Allowed)

	Percent of Respondents
Base (n)	*7**
Recommend heat pumps / heat pumps more efficient	57%
Too expensive for some households	14%
Structural constraints in home (flue location, electrical panel access)	14%
Other	14%

Totals may not sum due to rounding
** Caution is advised when comparing responses based on small samples*

Forty-four percent (44%) of trade allies said they recommend two-stage mid-efficiency furnaces as an alternative to a high efficiency furnace (Exhibit 62). An additional 18% of respondents said it depended upon the customer.

Exhibit 62: Recommend Two-Stage Mid-Efficiency Furnaces as Preferred Option to High Efficiency Furnace?

	Percent of Trade Allies
Base (n)	*50*
Yes	44%
No	38%
Sometimes / Depends upon the customer	18%

The reasons why trade allies recommend / sometimes recommend two-stage mid-efficiency furnaces over high efficiency furnaces are summarized in Exhibit 63. The top two reasons provided by trade allies were that they are a more affordable option for homeowners (mentioned by 26% of trade allies recommending / sometimes recommending two-stage mid-efficiency furnaces), and because the house could not accommodate a high efficiency furnace (16%). Six percent (6%) said it was because the house had a heat pump rather than a furnace.

Exhibit 63: Reasons Why Two-Stage Mid-Efficiency Furnaces Recommended / Sometimes Recommended over High Efficiency Furnaces
Percent of Respondents (Multiple Responses Allowed)

	Percent of Respondents
Base (n)	*31*
Cheaper / More affordable than high efficiency furnace	26%
House cannot accommodate high efficiency furnace	16%
Customer needs / choice	10%
More efficient than single-stage furnace	10%
House has heat pump	6%
More comfortable than single-stage furnace	6%
Next best option to high efficiency furnace	6%
Quieter than single-stage furnace	3%
Uses less electricity than single stage furnace	3%
Other	23%

Totals may not sum due to rounding

The reasons why some trade allies did not recommend two-stage mid-efficiency furnaces as a preferred option to high efficiency furnaces are provided in Exhibit 64. High efficiency furnaces were considered the preferred choice by 32% of trade allies not recommending mid-efficiency furnaces, and 15% of respondents felt there was little price advantage relative to high efficiency models, especially when the Terasen rebate was included. The presence of a heat pump was mentioned by 10% of trade allies.

Exhibit 64: Reasons Why Two-Stage Mid-Efficiency Furnaces Not Recommended over High Efficiency Furnaces
Percent of Respondents (Multiple Responses Allowed)

	Percent of Respondents
Base (n)	*19**
High efficiency furnaces are preferred choice	32%
Little price advantage relative to high efficiency furnaces [especially with rebate]	15%
House has heat pump	10%
Not as efficient as high efficiency furnaces	5%
Other	26%
DK/NR	16%

Totals may not sum due to rounding
** Caution is advised when comparing responses based on small samples*

Ninety-four percent (94%) of trade allies recommend / sometimes recommend variable speed blower motors to their customer**s (**Exhibit 65).

Exhibit 65: Recommend Variable Speed Blower Motors?

	Percent of Trade Allies
Base (n)	*50*
Yes	88%
No	6%
Sometimes / Depends upon the customer	6%

Efficiency (mentioned by 34% of trade allies who recommend / sometimes recommend VSMs), saves money (34%), quieter operation (30%), and improved comfort / more even heat distribution (26%) were the four most frequently mentioned reasons why contractors recommend or sometimes recommend variable speed blower motor-equipped furnaces (Exhibit 66).

Exhibit 66: Reasons Why Contractors Recommend / Sometimes Recommend VSMs
Percent of Respondents (Multiple Responses Allowed)

	Percent of Respondents
Base (n)	*47*
Energy-efficient / more efficient	34%
Saves money / saves electricity	34%
Quieter operation	30%
Improved comfort / more even heat distribution	26%
Better quality / last longer	9%
Filtration / better air quality	9%
Continuous operation	4%
Easier to install	2%
More control	2%
Some people have different needs	2%
Other	23%
DK/NR	6%

Totals may not sum due to rounding

Trade allies were asked to indicate the proportion of replacement furnace sales made during the program period by blower motor type – single speed PSC, multi-speed PSC, and VSM. On average, VSM-equipped furnaces represented 47% of sales while Teresan's rebate program was in effect, followed by multi-speed PSC-equipped furnaces (41%), and single speed PSC-equipped furnaces (13%) (Exhibit 67).

Exhibit 67: Distribution of Furnace Sales During the Program by Furnace Blower Motor Type

	Single Speed PSC	Multi-Speed PSC	VSM
Base (n)	*50*	*50*	*50*
0%	54%	6%	10%
1% to 20%	22%	30%	18%
21% to 40%	8%	20%	22%
41% to 60%	4%	14%	16%
61% to 80%	6%	14%	4%
81% to 100%	0%	10%	26%
DK/NR	6%	6%	4%
Total	100%	100%	100%
Mean	*13%*	*41%*	*47%*

Totals may not sum due to rounding

Trade allies who sold VSM-equipped furnaces during the program period said that 24% and 54% of mid-efficiency and high efficiency furnaces respectively sold during the program were equipped with variable speed blower motors (Exhibit 68).

Exhibit 68: Proportion of Furnaces Sold with VSMs – Mid-versus High Efficiency Furnaces

	Percent Sold with VSMs
Base (n)	*50*
Mid-Efficiency Furnaces	24%
High-Efficiency Furnaces	54%

Reasons why their customers purchased a furnace with a variable speed blower motor are ordered by frequency of mention in Exhibit 69. Four reasons were the most frequently mentioned including using less electricity (mentioned by 42% of trade allies), quieter operation (40%), more comfortable ventilation (32%), and the $100 rebate (26%).

Exhibit 69: Customer Reasons for Purchasing a Furnace with a VSM – Contractor's Perspective Percent of Trade Allies - Multiple Responses Allowed

	Percent of Trade Allies
Base (n)	*50*
It uses less electricity	42%
It is quieter	40%
It provides more comfortable ventilation	32%
The $100 rebate	26%
Customer wanted continuous ventilation	16%
It can operate through a range of speeds	6%
Contractor / sales person sold the feature	4%
Customer wanted the "best" furnace	2%
Came with the furnace that was ordered	2%
Other	-
DK/NR	2%

4.4 Furnace Characteristics

Trade allies were asked to estimate the proportion of replacement furnaces they installed during the program period that were eligible for a Terasen incentive. Trade allies reported that, on average, 54% of all furnaces they replaced between September 2005 and March 2007 were eligible for a rebate.

Exhibit 70 summarizes the average remaining life of furnaces replaced while operational. The average of the valid responses (i.e., excluding DK/NR) was 4.7 years. The most frequently recorded response was five years (34% of all responses).

Exhibit 70: Remaining Life of Furnaces Still Operational When Replaced

	Value
Base (n)	*50*
1 Year or less	16%
2 to 5 years	58%
More than 5 years	20%
DK/NR	6%
Total	100%
Mean	*4.7*

4.5 Frequency and Impact of Heat Loss Calculations

The correct sizing of a furnace is important for maximizing the cost effectiveness of a new furnace and is determined by conducting a heat loss calculation. A heat loss calculation determines the amount of heating in GJ (i.e., the size of furnace) needed to replace the heat lost from a home during the cold winter months. Heat loss calculations consider several variables including the square footage of the home, the number, type, and orientation of windows, outside wall construction, insulation thickness, and size of exterior doors. While the particular method used to determine heat loss were not queried, contractors have access to heat loss/furnace sizing methodologies provided by the Canadian Standards Association (CAN/CSA F280) and the Heating, Refrigeration, and Air Conditioning Institute of Canada (HRAI).[6]

Of the trade allies surveyed, 78% said they routinely conduct a heat loss calculation prior to installing the furnace, significantly higher than 48% of trade allies surveyed in 2004. Although the proportion of trade allies conducting a heat loss calculation has improved, the percentage of the calculations that lead to the installation of small capacity furnace varies depending upon the trade ally (Exhibit 71).

Exhibit 71: Share of Heat Loss Calculations that Lead to Smaller Capacity Furnace
Percent of Trade Allies That Routinely Conduct a Heat Loss Calculation

	Percent of Trade Allies
Base (n)	*39*
0%	8%
1% to 10%	15%
11% to 50%	21%
51% to 80%	18%
81% to 100%	28%
DK/NR	10%
Total	100%
Mean	*55%*

Totals may not sum due to rounding

On average, contractors estimated that the heat loss calculation leads to a recommendation to install a smaller capacity furnace in more than half (55%) of the cases.

6 Source: Canada Housing and Mortgage Corporation, www.cmhc-schl.gc.ca/en/co/renoho/refash/refash_018.cfm

4.6 Furnace Fan Usage

Trade allies were asked questions regarding the operating behaviours of furnace fans before and after the furnace change-out. Fan operation after the change-out was differentiated by furnaces equipped with PSC versus VSM blower motors. The results from these questions are summarized in Exhibit 72.

Exhibit 72: Trade Ally Perspective on Pre- and Post-Replacement Furnace Fan Behaviours

	All Replaced Furnaces	New Furnaces with PSC Motors	New Furnaces with VSM Motors
Base (n)	*50*	*50*	*50*
Intermittently when providing heat	30%	30%	26%
Continuously during the heating season	17%	16%	13%
Intermittently when providing heat or air conditioning	29%	23%	21%
Continuously during the heating / cooling seasons	6%	5%	9%
Intermittently to also provide ventilation for part of the year	6%	6%	6%
Continuously	15%	16%	28%
DK/NR	22%	20%	21%

Totals may not sum due to rounding

Trade allies installing VSM-equipped furnaces reported a significant increase in the continuous use of the furnace fan (increase from 15% of pre-retrofit furnaces to 28% of post-retrofit furnaces equipped with VSM blower motors) and a decline in the percentage of furnace fans operating intermittently to provide heat or air conditioning (29% to 21%).

4.7 Program Design Issues

All but one of the 50 trade allies surveyed (98%) were familiar with Energy Star label for natural gas furnaces. Of these, 90% recommended Energy Star natural gas furnaces to their customers, and another 4% said they sometimes recommended them depending upon the customer’s requirements. Six percent of trade allies do not recommended Energy Star natural gas furnaces (Exhibit 73).

Exhibit 73: Energy Star Furnaces Recommended to Customers?

	Percent of Trade Allies
Base (n)	*50*
Yes	90%
No	6%
Sometimes / Depends on the customer	4%
Total	100%

Totals may not sum due to rounding

Eighty-two percent (82%) of trade allies felt customers had enough information to make an informed decision about the choice of furnace (Exhibit 74). Another four percent qualified their response by saying that customers sometimes had sufficient information or that it depended upon the customer.

Exhibit 74: Do Customers Have Enough Information to Make an Informed Decision on Choice of Furnace?

	Percent of Trade Allies
Base (n)	*50*
Yes	82%
No	14%
Sometimes / Depends on the customer	4%
Total	100%

Totals may not sum due to rounding

The comments from the handful of trade allies who answered no to this question are listed verbatim in Exhibit 75. Trade allies suggested that households rely upon contractors to educate them on mid-to high efficiency furnaces. This education process includes both the mechanics of upgrading to a high efficiency furnace, and placing the furnace prices in the context of expected savings.

Exhibit 75: Information Missing Regarding the Choice of Furnace Efficiency Percent of Respondents

	Percent of Respondents
Base (n)	*9**
Some don't understand about the mid-efficiency furnace.	2%
Some understand the mechanics, and some have no idea at all.	2%
Terasen doesn't explain it.	2%
The efficiency for high efficiency is so much higher. This is what they want, but they get a price regarding that and basically walk away.	2%
They are missing everything without us to explain it to the customers.	2%
They are not informed of the actual savings they will receive by installing the high efficiency furnace.	2%
They are not well informed about furnaces until they speak with us.	2%
They don't know how they [furnaces] work	2%
DK/NR	2%

** Caution is advised when comparing responses based on small samples*

Seventy-eight percent (78%) of trade allies felt customers had sufficient information to choose between a PSC or VSM-equipped furnace (Exhibit 76). Another 6% said they sometimes had sufficient information or that it depends upon the customer.

Exhibit 76: Do Customers Have Enough Information Regarding the Choice of a PSC or Variable Speed Furnace Motor?

	Percent of Trade Allies
Base (n)	*50*
Yes	78%
No	16%
Sometimes / Depends on the customer	6%
Total	100%

Feedback from trade allies who felt households did not have enough information regarding the choice of furnace motor blower type is listed in Exhibit 77. Several alluded to the tendency for customers to use contractors to explain the differences and/or benefits of the different blower motor technologies. Others referred to barriers associated with building codes, customer lack of interest, uniformed salespeople, or because the trade ally does not recommend furnaces with VSMs.

Exhibit 77: What Information is Missing Regarding the Choice of Furnace Blower Motor? Trade Allies Who Felt Customers Did Not Have Enough Information Regarding the Choice of a PSC or Variable Speed Furnace Motor

	Percent of Respondents
Base (n)	*11**
A lot of them don't know what the effects of the blower motor are.	2%
I don't give information on the variable speed motors because I don't use them.	2%
I explain the differences between the two motors.	2%
I tell them about the efficiency of the motor.	2%
It is hard, especially with the codes, so it depends due to the fact of the codes.	2%
Some people care, and some don't have an interest in it.	2%
Terasen doesn't provide it.	2%
The only way they know is if we tell them, or if they have gone on the internet to find information.	2%
They don't know about how efficient they are. They know the cost may be higher, but that they do pay for themselves.	2%
You can't even teach salespeople because the technicians have all the technical information.	2%
DK/NR	2%

** Caution is advised when comparing responses based on small samples*

4.8 Trade Ally Suggestions – High Efficiency Furnaces

Trade allies were asked how customers could be encouraged to install high efficiency rather than mid-efficiency furnaces. Trade ally suggestions could be grouped by three primary themes: (1) improve education and awareness of high efficiency furnaces, (2) lower the cost of high efficiency furnaces, and (3) improve program delivery. Exhibit 78 summarizes the responses by these three themes.

Exhibit 78: Suggestions on How to Encourage Customers to Choose High-Efficiency Furnaces over Mid-Efficiency Furnaces
Percent of Trade Allies - Multiple Responses Allowed

	Percent of All Trade Allies *
Base (n)	*50*
Improve education and awareness	
Increase emphasis on the benefits of high efficiency furnaces ($ savings, environment, resale value of home)	38%
Increase awareness of rebates (Terasen, federal government, manufacturer, etc.)	4%
Increase the amount of promotion (generic)	2%
Educate customers on construction of their home	2%
Lower the cost of high-efficiency furnaces	
Reinstate rebate	2%
Increase the rebate	10%
Pressure wholesalers to reduce cost	4%
Make dealers offer rebates	2%
Improve size of federal government rebate	2%
Improve program delivery	
Run program year round	4%
Improve access (generic)	2%
More promotion prior to start of heating season	2%
No Suggestions	36%

** Suggestions are not additive as multiple responses were allowed.*

The majority of suggestions made on ways to encourage the adoption of high efficiency furnaces focused on raising the awareness and educating customers about high efficiency furnaces. The majority of suggestions in this sub-group focused on emphasizing the benefits of high efficiency furnaces (mentioned by 38% of all trade allies), including the cost savings, environmental benefits, and improved resale value of the home. The next most common group of suggestions revolved around lowering the cost of high efficiency furnaces through the use of rebates or pressuring dealers and wholesalers to lower their prices. While increasing the amount of the rebate was the most frequently made suggestion in this sub-group, it was mentioned by only 10% of trade allies. A small number of trade allies (2% to 4%) suggested changes to program delivery, including extending the program year round, and increasing the amount of program promotion prior to the start of the heating season. Thirty-six percent (36%) of trade allies did not offer suggestions.

4.9 Trade Ally Suggestions – Blower Motors

Suggestions on how to encourage customers to install variable speed furnace motors rather than the less efficient PSC motors could be arranged by three major subject groups: provide education / raise awareness of VSMs, lower the cost of VSM-equipped furnaces, and/or miscellaneous (other). Exhibit 79 summarizes the suggestions by these three subject areas.

Suggestions related to providing education on the costs, benefits, and operating characteristics of installing furnaces with VSMs were offered by trade allies surveyed. Within this general category, trade allies most frequently mentioned raising the awareness of the cost savings (mentioned by 26% of trade allies). Other benefits cited included air quality, quieter operation, improved comfort, and durability. Consistent with the themes heard throughout the survey, several trade allies suggested that

Terasen emphasize the environmental benefits of VSM-equipped furnaces in their education and awareness programming. As well, several trade allies felt customers needed to be educated on how VSMs work, and how their operating characteristics differ from PSC-equipped furnaces. One trade ally alluded to legislating a ban on the sale of PSC-equipped furnaces, while another felt manufacturers should bear more of the responsibility of increasing VSM sales. Twenty-six percent (26%) of trade allies did not offer any suggestions.

Exhibit 79: Suggested Ways to Encourage Customers to Choose Variable Speed Blower Motors over PSC Motors
Percent of Trade Allies - Multiple Responses Allowed

	Percent of Trade Allies
Base (n)	*50*
Provide Education / Raise Awareness of VSMs	
Raise awareness of benefits – cost savings	26%
Raise awareness (generic)	10%
Educate customers on how they work	8%
Raise awareness of benefits - quieter operation	6%
Raise awareness of benefits - improved air quality	4%
Raise awareness of benefits - comfort	4%
Raise awareness of benefits - environment	2%
Raise awareness of benefits - last longer	2%
Lower the cost of VSM-equipped furnaces	
Increase rebate	22%
Reduce cost of VSMs	2%
Other	
Make VSMs the only choice	2%
Make manufacturers take more responsibility	2%
No suggestions	26%

4.10 Prices

Trade allies provided typical equipment and installed prices for a 90,000 Btu/hour mid-efficiency furnace, a 90,000 Btu/hour high efficiency furnace, and a 75,000 Btu/hour high efficiency furnace. The means of the responses for each furnace type are provided in Exhibit 80. The difference between the mean equipment and installed price effectively represents an approximation of the installation cost.

Exhibit 80: Mean Equipment and Installed Furnace Prices

	90,000 BTU/Hr Mid-efficiency	90,000 BTU/Hr High Efficiency	75,000 BTU/Hr High Efficiency
*Base (n)**	*37-39*	*39-41*	*37-40*
Equipment Price (a)	$1,569	$2,246	$1,925
Installed Price (b)	$2,487	$3,452	$3,183
Installation (b-a)	$918	$1,206	$1,258

** base varies because of differing proportions of DK/NR*

The average equipment price for a 75,000 Btu/hour high efficiency furnace was 23% more than a 90,000 Btu/hour mid-efficiency furnace. Because of its higher efficiency, a 75,000 BTU/hour high efficiency furnace is comparable in its output to a 90,000 BTU/hour mid-efficiency furnace. Installation costs were also higher for the higher efficiency model (37% more), likely reflecting the need to vent the furnace through the side of the house and higher set up costs. Including equipment and installation costs, a 75,000 BTU/hour high efficiency furnace costs 28% more than a 90,000 BTU/hour mid-efficiency furnace.

Equipment costs for a 90,000 Btu/hour high efficiency furnace were significantly higher than a 75,000 Btu/hour high efficiency furnace, commensurate with its size. Installation costs, however, did not statistically differ between the two models.

4.11 Free Riders

Trade allies were asked to rate the importance of the Terasen rebate in their customers' choice of furnace efficiency on a five point scale, where five represented "very important" and one was "not at all important". Trade allies gave an average importance rating of 3.7 out of 5.0. Exhibit 81 uses weights to derive the trade ally based estimate of free riders. A weight of 1 is given to the highest score, 0.75 to the next, 0.5 to the next, and so on. Weights of zero were assigned to an importance score of 1 or DK/NR. Using this method, 66% of trade allies felt the rebate influenced their customers' choice of furnace efficiency, implying a free rider rate of 33%.

Exhibit 81: Trade Ally Estimate of Free Riders – Influence of Overall Incentive

	Very Important (5)	(4)	(3)	(2)	Not at all Important (1)	DK/NR	Total	Free Rider Rate
Distribution of Responses (n=50)	34%	24%	20%	14%	4%	4%	100%	-
Weight	1	.75	.50	.25	0	0	-	-
Product	0.34	0.18	0.10	0.04	0.00	0.00	0.66	**0.33**

Trade allies were next asked to rate the importance of the $100 rebate that was offered to customers who purchased a VSM-equipped furnace. Trade allies gave an average importance score of 3.2 out of 5.0. Using weights identical to those used with the previous question, it is estimated that 53% of customers receiving the VSM rebate would not have purchased the VSM-equipped furnace if the rebate had not been available (Exhibit 82). This suggests a free rider rate for the VSM incentive of 47%.

Exhibit 82: Trade Ally Estimate of Free Riders – Influence of VSM Incentive on Blower Motor Choice

	Very Important (5)	(4)	(3)	(2)	Not at all Important (1)	DK/NR	Total	Free Rider Rate
Distribution of Responses (n=50)	20%	26%	18%	18%	16%	2%	100%	-
Weight	1	.75	.5	.25	0	0	-	-
Product	0.20	0.20	0.09	0.05	0.00	0.00	0.53	**0.47**

The next section compares and discusses the relative merits of the free rider estimates derived from trade ally data versus those derived from the customer survey. Based on that discussion, the decision was made to use the customer survey based free rider estimates in the calculation of program impact.

5 Impact Analysis

This section summarizes the analysis and calculations used to derive a preliminary estimate of energy savings associated with Terasen's 2005-07 Heating System Upgrade Program. Key factors influencing net program savings include attribution (free riders), spillover (advancement of the furnace replacement decision), and operational/behavioural changes. Estimates of program savings are preliminary at this point and will be revised using a comparison of billing histories for participants and non-participants (billing analysis). The billing analysis will occur after participants have used their new furnaces for one full heating and cooling season (12 months). This will allow a comparison of their energy use patterns pre- and post-furnace change-out and will factor in behavioural changes using a comparable group of non-participants. Behavioural changes at this stage of the program's evaluation are limited to description and discussion only.

5.1 Operational/Behavioural Changes

Following the decision of which furnace model to purchase, homeowners can influence the amount of savings realized from the operation of their new furnace in three primary ways:

- pre-post changes in the furnace fan use;
- pre-post changes in furnace settings, most importantly the thermostat or fan operating settings; and
- pre-post changes in the use of supplementary heating.

5.2 Furnace Fan Use

How homeowners use their furnace to heat or cool the house, or to provide ventilation either occasionally or continuously, ultimately affects the amount of energy savings realized from installing a VSM-equipped furnace (assuming their old furnace used a PSC motor). These behaviours also influence the program's economics that justify incentives encouraging the adoption of VSM-equipped furnaces. The economics of VSM blowers are such that households that tended to use their old PSC-equipped furnaces to provide heating/cooling on a continuous basis, and/or to run their fans intermittently to provide ventilation or air circulation, will realize the greatest electricity savings from switching to a furnace with a VSM blower motor. Households that use their fans only intermittently to provide heating or cooling realize considerably less savings. In short, insufficient operating hours significantly increases the payback period for VSM-equipped furnaces. Data from the customer and trade ally surveys on furnace fan behaviours before and after replacing the furnace were analyzed to better understand the cost effectiveness, and targeting, of the VSM incentive.

Information on fan usage from the customer survey was recombined to create four primary groups of fan use – intermittent (heat / cool season), continuous (heat / cool season), to provide ventilation, and continuous. These results were then cross-tabulated by the type of furnace blower motor on the new furnace (PSC versus VSM). Participants and non-participants were combined by furnace blower motor choice to facilitate interpretation. The distribution of fan use for the two motor types was rebased to exclude DK/NR and households without furnace fans (boilers). The results of this analysis are presented in Exhibit 83.

Exhibit 83: Pre-Post Furnace Fan Behaviours by Blower Motor Type (Customer Survey) Participants and Non-Participants Combined

	Before		After		Net Change	
Post Furnace Change Motor Type >	**PSC**	**VSM**	**PSC**	**VSM**	**PSC**	**VSM**
Base (n)	33	98	32	96	-	-
Intermittently (heat / cool season)	55%	60%	47%	52%	-8%	-8%
Continuously (heat / cool season)	36%	31%	41%	32%	+5%	+1%
To also provide ventilation	3%	4%	6%	7%	+3%	+3%
Continuously	6%	5%	6%	8%	0%	+3%

The data suggest that relatively fewer households from both groups – those who installed PSC-equipped furnaces and those who installed VSM-equipped furnaces – are using their new furnace to intermittently heat or cool their homes during the heating/cooling seasons (8% of households for each group). The proportion of households using their furnace fan to provide continuous heat or cooling during the heating / cooling seasons also increased although a larger proportion of PSC households (+5%) did versus VSM-equipped households (+1%). The proportion of households that use their fan to provide ventilation for part of the year increased equally for both groups (+3%); however the proportion of VSM-equipped households that use their fans continuously increased by 3%.

Based on the data presented in Sections 3 and 4 of this report, and this analysis, there are several observations that can be made. One, households that replaced their old PSC-equipped furnace with a VSM-equipped furnace are comprised of several user types. Two, some households have changed how they use their furnace fan after installing their new furnace. Some have gone from using their furnace fan intermittently to continuous use or to provide ventilation, while others have not changed their behaviours – using their furnace fan only on an intermittent basis (yielding the least electricity savings), or running their fan continuously or to provide ventilation in the pre-post periods (highest electricity savings from switching to VSMs). The amount of electricity savings is directly related to pre-post operating hours of the furnace fan, thus the economics of the VSM incentive will depend upon the relative proportion of those who tended to use their fan the most in the pre-change out period and continue to do so afterwards. Finally, there is also evidence that, regardless of motor type, some households have used the furnace replacement decision as an opportunity to add air conditioning. A similar observation was made in the 2004 evaluation (Habart 2004). Finally, while electricity use for both PSC and VSM users will increase due to the addition of air conditioning, those with VSMs should realize some savings relative to PSC-equipped furnaces as VSMs give off less heat than PSC motors.

The finding that some households that installed PSC-equipped furnaces have increased their use of the furnace fan to provide continuous heat/cooling or to provide ventilation for part of the year may be due to improvements in the operating characteristics of the new furnace (e.g., two-stage burner, multi-speed PSC fan motor).

Data from the customer survey suggests that households that had higher operating hours for their old furnace fan (i.e., operated their fans continuously or for air circulation / ventilation) were no more likely to purchase a furnace equipped with VSM than those who had lower operating hours. Instead, energy efficiency and the recommendation of the contractor appear to be relatively more important than the desire for improved circulation / ventilation for many households that purchased a furnace equipped with a VSM blower (Exhibit 31, p. 25). It may be that some of these households were expecting significant electricity savings, but because they used their fan only intermittently prior to the furnace change-out they have been disappointed. Indeed, households with VSM-equipped furnaces rated their satisfaction with the electricity bill savings as 3.8 out of 5.0, significantly lower than the 4.2 satisfaction rating assigned by households who installed PSC-equipped furnaces (Exhibit 19, p. 18). There is also sufficient evidence to suggest that the non-energy benefits of purchasing a high efficiency furnace equipped with a VSM motor (e.g., improved comfort, improved air quality via air circulation, pollen filters, etc.) influenced the decision to purchase the furnace, and is influencing how that furnace is now operated. Non-energy benefits are common selling features for VSM-equipped furnaces.

Information on the before and after use of the furnace fan provided by trade allies was reviewed to provide alternative insight into furnace fan operating behaviours. Trade allies were questioned about fan usage for furnaces they replaced (the majority of these are assumed to be PSC equipped furnaces), newly installed PSC equipped furnaces, and newly installed furnaces with VSMs. Trade allies were not asked about operating behaviours for replaced VSM equipped furnaces as very few VSM models were available prior to 2000 and thus very few households would be replacing a VSM equipped furnace.

Exhibit 84 summarizes the trade ally data organized into the four operating behaviour groupings, rebased to eliminate non-responses (DK/NR). Compared to the old furnace, newly installed VSM-equipped furnaces were more likely to have their fans operate continuously (up from 15% to 27%) and less likely to operate intermittently during the heating / cooling seasons (down from 57% to 46%).

Exhibit 84: Pre-Post Furnace Fan Behaviours by Blower Motor Type (Trade Ally Survey) Percent of Households

	PSC Furnaces		VSM-Equipped Furnaces	Net Change	
	Before	After	After	PSC Equipped Furnaces	VSM-Equipped Furnaces **
Base (n) *	38-40	38-39	37-38	-	-
Intermittently (heat / cool season)	57%	56%	46%	-1%	-11%
Continuously (heat / cool season)	22%	21%	21%	-1%	-1%
To also provide ventilation	6%	6%	6%	0%	0%
Continuously	15%	17%	27%	+2%	+12%

* *Excludes DK/NR*
** *VSM equipped furnaces compared to PSC furnaces*

Compared to the customer surveys, the trade ally data suggest a significantly larger increase in the proportion of households that shift from intermittent to continuous use. It also suggests no change in the relative proportion of households using their furnaces either continuously to provide heat or cooling, or to provide ventilation.

5.3 Changes to Furnace Operating & Control Settings

Exhibit 85 shows that 22% of participants and 9% of non-participants are setting the thermostat lower during the winter months compared to before they replaced their furnace. Only 4% of participants and 11% of non-participants have adjusted their thermostat to keep their house warmer compared to before the furnace change out.

When participants who turned up their thermostat are added to those who turned down their thermostat and those who made no change, the net change in indoor temperature for participants as a group is negative (-0.6^{o} Celsius). It may well be that the increase in home comfort associated with the high efficiency furnaces (e.g., less temperature variation between rooms, better temperature maintenance between furnace cycles, etc.) led participants to lower their thermostat. This, everything else held constant, should increase energy savings somewhat.[7]

Exhibit 85: Average Degree (Celsius) Change in Thermostat Setting since Furnace Change Winter Months

	Change in Indoor Temperature Post-Installation		Amount Warmer / Cooler (Degrees Celsius)		
	Participants	Non-Participants	Participants	Non-Participants	All Respondents
Base (n)	100	100	*100*	*100*	*200*
Warmer	4%	11%	4.7	5.0	4.9
Cooler	22%	9%	3.3	2.5	2.9
No Change	67%	70%	0.0	0.0	0.0
DK/NR/Too soon to tell	7%	10%	-	-	-
Net Change	-	-	-0.6	0.4	-0.2

** Weighted average change including no change (0^o)*

In contrast to participants, non-participants, overall, increased their thermostat setting by 0.4 degrees Celsius. When combined with the 0.6 degree Celsius decline in temperature reported by participants, this suggests that participation in the Terasen furnace program results in a one degree reduction in average temperature setting, and should, everything else held constant, add to participant savings. The forthcoming billing analysis will implicitly capture any relative differences in temperature setting.

5.4 Other Changes to Furnace Settings

Only 5% of participants and 1% of non-participants reported changing one or more operating settings on their furnace (other than the thermostat setting). The relatively small number of households changing their furnace settings, and the nature of the changes identified (e.g., changing the furnace to run less frequently, resetting the blower, installing a digital readout, and installing air conditioning, etc.) suggest these changes are too small to be isolated in determining program savings – using either an engineering estimate or billing analysis approach.

5.5 Changes in Supplemental Heating

Changes in the use of supplementary heating following the installation of the new furnace has the potential to increase or decrease the savings from the furnace upgrade. Reduced use of a supplemental heat source following the furnace change-out means that, everything else held constant, the heating load carried by the natural gas furnace should increase. If the displaced secondary fuel is electricity, then pre-post bill savings for natural gas will be reduced.[8] However, if the secondary fuel is natural gas, then savings are likely increased as the high efficiency furnace will be more efficient that the secondary heat source, such as a fireplace.

Data from the customer survey regarding supplementary heat sources, and the fuel type for supplementary heat, revealed that natural gas fireplaces are the most common source of supplementary

[7] Natural Resources Canada's website suggests that a 1 degree reduction in thermostat setting translates into a 2% reduction in heating costs (www.nrcan.oee.nrcan.gc.ca).

[8] The program should receive credit for the electricity savings in the Total Resource Cost test. However, there is insufficient data in the evaluation methodology to estimate this impact accurately.

heating; present in 41% of participant homes.[9] This suggests that natural gas savings should increase somewhat in these homes if the new high efficiency furnace picks up some or all of the heating load previously carried by the lesser efficient natural gas fireplace.

Exhibit 86 shows that the majority of participants and non-participants (52% and 53% respectively) indicated their use of supplementary heating had not changed since installing their furnace.

Exhibit 86: Change in Supplementary Heating Use since Furnace Replacement Among Those with Supplementary Heating

	Total	Participants	Non-Participants	PSC	VSM	Unknown Blower Motor Type
Base (n)	*88*	*48*	*40*	*20**	*50*	*18**
Increase	8%	6%	10%	5%	12%	0%
Decrease	30%	33%	25%	35%	32%	17%
Stay the Same	52%	52%	53%	45%	48%	72%
DK/NR	10%	8%	13%	15%	8%	11%
Total	100%	100%	100%	100%	100%	100%

** Caution is advised when comparing responses based on small samples*

If the data are rebased to exclude the differing number of non-responses for the two groups (data not presented in tabular format), the proportion of participants reporting a decrease in their use of supplemental heat increases to 36% (rebased) from 33% (non-rebased). Using the same rebasing technique, the proportion of non-participants reporting a decrease in supplemental heating increased to 29% from 25%. The proportion of participants and non-participants reporting increased use of supplemental heating represented 7% and 11% of the two groups, respectively, up from 6% and 10% respectively in the non-rebased series.

The amount of the decrease in supplementary heating, reported in one-quarter increments, is summarized in Exhibit 87. The estimated mean change was calculated by taking the mid-point value of each range (e.g., 0% to 24% was set to 12%, 25% to 49% was set to 37%, and so on) and weighting them by the proportion of responses for each range. This approach provides an approximate indication of relative differences in the reduction in supplementary heating use for participants compared to non-participants.[10] In this case, participants who decreased their use of supplementary heating, cut their use of supplementary heating by almost half (average reduction of 45%). In contrast, non-participants who reduced their use of supplementary heating, did so by 22% on average. A similar calculation was conducted for those who increased their supplementary heating (Exhibit 88).

[9] Determined by cross tabulating supplementary heat sources against fuel types used for supplementary heating. Table not shown.

[10] This procedure allows a comparison of the relative change and direction of change in supplementary heating use by a number of criteria such as program participation and type of blower motor. The comparisons are largely illustrative as the relative amount of energy used for supplementary heating prior to the furnace change is not known, only the relative change since installing the new furnace.

Exhibit 87: Amount of Decrease in Supplementary Heating since Furnace Replacement

	Total	Participants	Non-Participants	PSC	VSM	Unknown Blower Motor Type
Base (n)	*24**	*16**	*10**	*7**	*16**	*3**
0% to 24%	5%	5%	5%	57%	31%	33%
25% to 49%	4%	5%	3%	-	38%	67%
50% to 74%	1%	2%	-	-	13%	-
75% to 100%	2%	4%	-	14%	19%	-
DK/NR	1%	-	2%	29%	-	-
Total	100%	100%	100%	100%	100%	100%
Estimated Mean Decrease **	37%	45%	22%	28%	42%	29%

Totals may not sum due to rounding
** Caution is advised when comparing responses based on small samples*
*** Calculated as the response weighted average of the mid-points for each response category*

Exhibit 88: Amount of Increase in Supplementary Heating since Furnace Replacement

	Total	Participants	Non-Participants	PSC	VSM	Unknown Blower Motor Type
Base (n)	*7**	*3**	*4**	*1**	*6**	-
0% to 24%	43%	33%	50%	100%	33%	-
25% to 49%	14%	-	25%	-	17%	-
50% to 74%	0%	-	-	-	-	-
75% to 100%	14%	-	-	-	17%	-
DK/NR	29%	66%	25%	-	33%	-
Total	100%	100%	100%	100%	100%	-
Estimated Mean Increase **	32%	13%	37%	13%	37%	-

Totals may not sum due to rounding
** Caution is advised when comparing responses based on small samples*
*** Calculated as the response weighted average of the mid-points for each response category*

Weighted by the relative proportion that reported an increase, decrease, or no change to their supplementary heating, participants with supplementary heating reported a decrease of 16%, and non-participants recorded a 2% decrease (Exhibit 89). Weighted across all households – with or without supplementary heating – the average decrease in supplementary heating for participants and non-participants is 7% and 1%, respectively.

Exhibit 89: Net Change in Supplementary Heating since Furnace Replacement

	Total	Participants	Non-Participants	PSC	VSM	Unknown Blower Motor Type
Mean Increase	43%	33%	50%	100%	33%	-
Mean Decrease	14%	-	25%	-	17%	-
Estimated Mean Change *	-9%	-16%	-2%	-11%	-10%	-
Estimated Mean Change All Respondents **	-4%	-7%	-1%	-5%	-4%	-

** includes those with no change in supplementary heating*
*** calculated as the weighted average of those with and without supplementary heating.*
Totals may not sum due to rounding

The results appear to suggest that participants were more likely than non-participants to reduce their use of supplemental heating after replacing their furnace. This suggests that participants' new furnaces are picking up some of the heating load previously met through supplemental sources, most notably the natural gas fireplaces, and to a lesser degree, electric heaters (see Exhibit 47, p. 32).

Estimating the impact on program savings due to the change in supplementary heating, at this point, is problematic due to the considerable number of assumptions required to correctly proportion the heating load borne by the supplementary heating pre- and post-furnace change-out, and to adjust for differing AFUEs of supplementary end use equipment and appliances. Additionally, the heating load transfer may be less than it appears if supplementary heating in the pre-furnace change-out period was needed because of temperature variations between rooms, temperature fluctuations between furnace cycles, and so on – in effect, supplementary heating was being used to improve the comfort in the home or parts of the home. The forthcoming refinement of program savings using a billing analysis will implicitly capture these changes in supplementary heating use and the net impact of other changes in heating/cooling use.

5.6 Market Transformation – Replacement Market

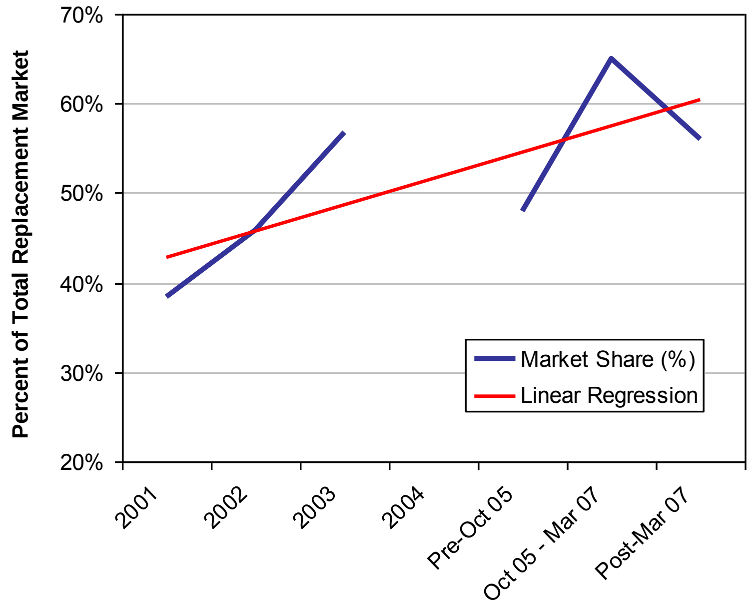
When first introduced to the market, high efficiency technologies are typically priced at a premium compared to standard efficiency units. This "first cost" premium can pose a barrier to the adoption of the technology – one which rebates and other incentives, combined with education and awareness programming, are designed to overcome. The incentives and related programming send signals to manufacturers and suppliers – both in terms of the intent to promote the high efficiency market, and through the eventual increase in demand for the high efficiency product. The mark of successful market transformation programs has been an increase in the awareness and availability of the high efficiency product, and a decline in the price differential between it and lesser efficient models. Understandably, the ability to transform a market depends on the scale and scope of the program, the ability for manufacturers to realize economies of scale, and a host of other factors that influence supply and demand for the technology in the market place.

5.7 Market Shares – High Efficiency Furnaces

Based on results from the survey of trade allies, the proportion of the replacement market captured by high efficiency furnaces saw an increase during the program period. High efficiency furnaces captured 65% of the market while the program was operating, up from 48% prior to launch, and then declining to 56% afterwards. The results from the customer survey suggested that the share of the replacement furnace market captured by high efficiency furnaces was 55% during the program period.

Figure 3 summarizes the replacement market share data from this evaluation and the 2004 evaluation. The data series is imperfect and caution in over-interpreting the results is advised. The time periods are inconsistent and data are missing for 2004, although pre-September 2005 does, by default, infer some overlap. Inserting a simple linear regression trend line suggests an upward trend in the proportion of the replacement furnace market captured by high efficiency furnaces. This was expected. The data does suggest that the market shares fall off after incentives cease. This, too, is expected and is commonly observed with incentive based demand-side management programs.

Figure 3: Shares of High Efficiency Furnaces in the Replacement Furnace Market
Source: Trade Ally Surveys – 2003, 2007



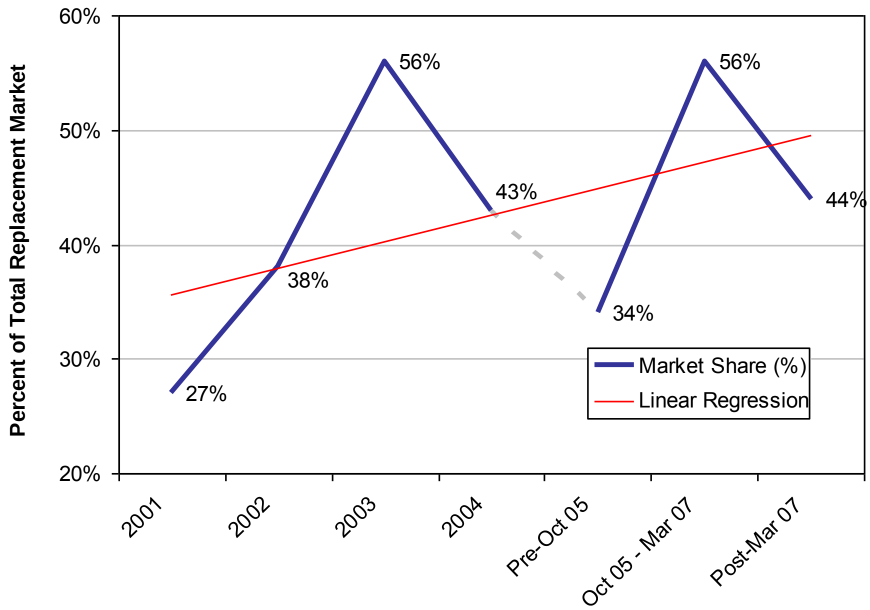
Trade allies reported that, on average, 54% of all furnaces they replaced between September 2005 and March 2007 were eligible for a rebate from Terasen Gas or its partners.

5.8 Market Shares – Variable Speed Motors

According to trade allies, the share of the replacement furnace market represented by furnaces with VSM blower motors increased from 34% in the pre-program period to 56% during the program, and falling to 44% in the post-program period. Data from the customer survey put the share of VSM-equipped furnaces (high or mid-efficiency) at 60%. Focusing just on high efficiency furnaces, Terasen's program records indicate that 65% of participants in the heating upgrade program opted for a high efficiency furnace equipped with a VSM blower motor.

Figure 4 pulls together VSM market share data from the 2004 evaluation and the trade ally estimates for the 2005-2007 period. The data, while imperfect for reasons discussed under furnace efficiency market shares, suggest a seesaw pattern, where VSM shares increase significantly during periods where Terasen's rebate program is in effect.

Figure 4: Share of VSM-equipped Furnaces in the Replacement Furnace Market
Source: Trade Ally Surveys – 2003, 2007



Despite the pullback in the periods following termination of incentives, the general trend in VSM market share for furnaces equipped with VSMs appears to be increasing.

5.9 Prices

For many homeowners, the cost of replacing a furnace (first cost) can be the predominate factor influencing the choice of furnace model efficiency. The relatively greater equipment and installation cost of a high efficiency furnace can become a barrier for households for several reasons: not excluding insufficient funds or access to funds (financing), plans to sell the home in near future (e.g., will not realize the long-term cost savings associated with a high efficiency unit), or a lack of understanding of the lifecycle cost savings from adopting a high efficiency unit.

The trend in prices of high versus mid-efficiency furnaces (i.e., lowest cost option now allowed by legislation) were explored using data from the 2007 trade ally survey and data gathered for the 2004 evaluation (survey conducted in 2003). The results in Exhibit 90 suggest that equipment prices have increased for both mid and high efficiency models over the four-year period. However, on an installed cost basis, a decline in installation costs has offset more than half (57% to 58%) of the increase.

Exhibit 90: Furnace Equipment and Costs for 90,000 BTU/Hr Units - 2007 Versus 2003

	90,000 BTU/Hr Mid-efficiency Furnace			90,000 BTU/Hr High Efficiency Furnace		
	2003	2007	Difference	2003	2007	Difference
Base (n)	*40*	*50*	-	*40*	*50*	-
Equipment Price (a)	$1,104	$1,569	$465	$1,806	$2,246	$440
Installation Charges (b-a)	$1,185	$918	-$267	$1,391	$1,206	-$185
Final Installed Price (b)	$2,289	$2,487	$198	$3,197	$3,452	$255

Exhibit 91 compares installed furnace prices for a 90,000 BTU/hour mid-efficiency furnace and a 75,000 BTU/hour high efficiency furnace for the years 2002, 2003 and 2007. Because of its higher efficiency, a 75,000 BTU/hour high efficiency furnace is comparable in its output to a 90,000 BTU/hour mid-efficiency furnace. The incremental installed cost declined from 2002 to 2003 from $877 to $608 before increasing to $696 in 2007.

Exhibit 91: Installed Furnace Costs – 2002, 2003, 2007

	90,000 BTU/Hr Mid-efficiency Furnace	75,000 BTU/Hr High Efficiency Furnace	Incremental Cost
2002	$2,194	$3,071	$877
2003	$2,289	$2,897	$608
2007	$2,487	$3,183	$696

Exhibit 92 compares the equipment and installation costs for the same two furnaces for the survey years 2003 and 2007. Of note, equipment costs for both furnaces are higher in 2007. In the case of the 90,000 BTU mid-efficiency furnace, a decline in the average installation cost has partially offset the $465 dollar increase in equipment cost. For the 75,000 BTU high efficiency model, equipment costs rose by $277 but installation costs were effectively unchanged.

Exhibit 92: Equipment and Installation Cost Comparisons - 2007 Versus 2003

	90,000 BTU/Hr Mid-efficiency Furnace			75,000 BTU/Hr High Efficiency Furnace		
	2003	2007	Difference	2003	2007	Difference
Base (n)	*40*	*50*	*-*	*40*	*50*	*-*
Equipment (a)	$1,104	$1,569	$465	$1,648	$1,925	$277
Installation Charges (b-a)	$1,185	$918	-$267	$1,249	$1,258	$9
Final Installed Cost (b)	$2,289	$2,487	$198	$2,897	$3,183	$286

The comparison of equipment and installation costs for the past two survey periods fails to provide an indication that the differential between a comparable mid-efficiency and high efficiency furnace has narrowed. Equipment prices for all models appear to have increased over the four year period. Installation costs for high efficiency models still remain higher than a mid- or standard efficiency unit.

5.10 Free Riders

5.10.1 Free Riders – High Efficiency Furnaces

The results from the participant and trade ally surveys provided two estimates of the free rider rate for high efficiency furnaces rebated under the Terasen program, with the participant survey suggesting 43% and the trade ally survey suggesting 33%. The relatively high proportion (58%) of non-participants who installed a high efficiency furnace but were unaware of Terasen's heating upgrade program (Exhibit 93) suggests that the free rider rate is probably closer to that estimated using participant survey data. The non-participant data should be interpreted with caution, as there is evidence that some have difficulty in accurately identifying the efficiency level of their furnace.

Exhibit 93: Non-Participant Furnace Efficiency Choice by Awareness of Terasen's Program

	Total	Aware	Unaware & DK/NR
Base (n)	*100*	*48*	*52*
Standard Efficiency	39%	48%	31%
High Efficiency	48%	38%	58%
DK/NR	13%	15%	12%
Total	100%	100%	100%

Totals may not sum due to rounding

5.10.2 Free Riders – Variable Speed Drives

The free rider rate for variable speed drives represents the proportion of participants who received the $100 incentive for purchasing a VSM-equipped furnace but would have purchased a VSM-equipped furnace without the incentive. Again, the participant and trade ally surveys provided two estimates of the free rider rate for VSMs. The participant survey suggested a free rider rate of 43% while the trade ally survey suggested a slightly higher rate of 47%. Which estimate is closer to the true rate is subject to interpretation.

The relatively high estimates are consistent with evidence that suggests the incentive was less instrumental in the decision to purchase than, for example, the potential to save energy or the recommendation of the furnace dealer/contractor (Exhibit 31, p. 25). The customer survey indicates that 34% of participants and 36% of non-participants who purchased a VSM-equipped furnace indicated they were aware of VSMs or considering the purchase of VSMs prior to purchasing their furnace. These households are most likely to be classed as potential free riders. However, awareness, while fundamental to the consideration of a VSM in the first place, doesn't necessarily ensure the choice of VSM-equipped furnace in the final decision by the consumer.

Exhibit 94 looks at the issue from the non-participant's perspective. The data suggest that 53% of non-participants who were unaware of Terasen's Heating System Upgrade Program purchased a furnace with a VSM. While this lends support to the use of the trade ally estimate, the free rider estimate of 43% derived from the participant survey will be used for determination of net impact because it was derived in a manner consistent with the free rider rate for high efficiency furnaces in general.

Exhibit 94: Non-Participant Blower Motor Choice by Awareness of Terasen's Program

	Total	Aware	Unaware & DK/NR
Base (n)	*70*	*32*	*38*
PSC	44%	41%	47%
VSM	56%	59%	53%
Total	100%	100%	100%

Totals may not sum due to rounding

5.11 Spillover

There are several reasons why households replace their old furnaces. Some furnaces cease working and require expensive repairs, while others are diagnosed as needing expensive repairs in the not-so-distant future. Some households will choose to replace their older, inefficient furnaces to realize energy savings or to improve the comfort in the home. However, change-outs such as these typically occur only when the furnace is nearing the end of its useful life.[11] Finally, some households made the decision to replace their furnace earlier than planned because of the availability of incentives, such as those offered through the Terasen Heating System Upgrade Program. The energy savings realized from advancing the decision to replace the furnace that can be attributed to Terasen's program are termed spillover savings. They are calculated by taking the difference in the efficiency levels of the replaced furnace and the new furnace, and multiplying the savings by the average number of years of advancement.

Spillover savings for Terasen's 2005-07 Heating System Upgrade Program were determined by querying participants about the operational status of their old furnace at the time of replacement, and then asking them whether the program caused them to advance their decision to replace the furnace. Finally, those participants who answered in the affirmative to both questions were asked to indicate by how many years they advanced their decision.

The customer survey found that 91% of participants' furnaces and 77% of non-participants' furnaces were still working and producing heat when replaced. The average age of the furnace at the time of replacement for participants was 24.1 years versus 24.7 years. These statistics confirm that participants were more likely to replace their furnaces prior to failure, and at an earlier age. Thirty percent (30%) of participants confirmed that they replaced their furnaces earlier than planned because of the availability of the rebate. They indicated an average advancement of 2.3 years.

5.12 Calculation of Program Savings

5.12.1 Key Inputs and Assumptions

Average AFUE for Rebated Furnaces

Program records listed brand names and corresponding model numbers, but not AFUE ratings for the rebated furnaces. To determine the average AFUE rating of the new high efficiency furnace for use in the impact calculations, a random sample of 400 participant furnaces were manually cross-referenced with the Energy Star database of qualifying natural gas furnaces.[12] Matching was based on the furnace brand name and model number. Where matches were not possible, the records were excluded from calculation of the AFUE average.[13] In cases where the Energy Star database listed a range of AFUE for a particular furnace model (e.g., 90.1% – 92.0%) , the lower AFUE rating was selected. In the end, 362 of the 400 participant records were matched successfully to an AFUE rating yielding an average AFUE rating of 93.0%. The previous evaluation had used an assumption of 92% AFUE.

AFUE and Average Consumption of Replaced Furnace Stock

Current legislation in British Columbia prohibits the sale of natural gas furnaces with an AFUE of less than 78%, defining the minimum efficiency base for calculating program savings. A billing analysis conducted for the 2002 Residential Heating System Upgrade program determined that the efficiency of the average furnace replaced during that year's program was 70.6%. As an update to this value is not available, it will be used for this analysis. The same study estimated the annual consumption of the average replaced furnace was 91.5 GJ. As an update to this value is not available, it will be used in the phase one impact analysis as well.

[11] Only 14% of households surveyed indicated their replaced furnace was younger than 15 years.

[12] The database is available for download from *http://www.energystar.gov/index.cfm?c=furnaces.pr_furnaces*

[13] Model numbers for gas furnaces can vary significantly between manufacturers, with most using lengthy alphanumeric combinations. Some of the model numbers recorded in the program database were either incomplete or had typographical errors making it impossible to accurately match the furnace model to the Energy Star database.

Number of Participants

Based on program records, 8,652 customers participated in the Terasen program during the September 2005 to March 2007 period. Of these, 5,667 applicants received an incentive for a VSM-equipped furnace.

Free Riders

Free riders in the overall program were estimated at 43%. Free riders among those participants receiving an incentive for a VSM-equipped furnace were calculated as 43%.

Spillover

Thirty percent (30%) or 2,596 participants indicated that they replaced their furnace earlier than planned because of the Terasen program. The average number of years of advancement for these customers was 2.3 years.

5.13 Energy Savings

The estimated energy savings attributable to Terasen's 2005-07 residential Heating System Upgrade Program is summarized in Exhibit 95. Based on a net-to-gross ratio of 0.57, the program generates 66.1 terajoules (TJ) in annual savings, plus an additional 22.6 TJ of savings for the first 2.3 years (spillover).

Exhibit 95: Energy Savings Estimates – September 2005-March 2007

	Unit Savings (GJ)	Gross Participants	Gross Savings (TJ)	Net to Gross Ratio	Net Savings (TJ)
Direct	13.4	8,652	115.9	0.57	66.1
Spillover	8.7	2,596	22.6	--	22.6
Annual – first 2.3 years	-	-	-	-	88.7
Annual – subsequent years	-	-	-	-	66.1

5.14 Peak Day Reductions

To estimate peak savings, the heating load on any day is assumed proportional to the heating degree days for that day. In the coldest month (January) the average daily heating load is equal to:

Annual Heating Load (GJ) * Monthly Share of Annual Heating Degree Days (January) * 1/31 days

The change in peak day load is then calculated as the change in average daily load for January. Exhibit 96 calculates the weighted peak day heating load share for January using a representative weather station for each of Terasen's five zones and the thirty year typical meteorological year heating degree-day shares for the month. Estimated peak day savings are then calculated as the weighted peak day heating load share for January multiplied by net savings. Estimated peak day savings are 0.48430 TJ for the first 2.3 years, and then 0.36091 TJ for the remaining years.

Exhibit 96: Peak Day Savings

	Representative Weather Station	Zone Customer Share	Peak Day Heating Load Share	Weighted Peak Day Heating Load Share	Peak Day Savings (TJ) – First 2.3 years (Including Spillover)	Peak Day Savings (TJ) – Remaining Years
Zone 1	Vancouver	0.244	0.00501	0.00122	-	-
Zone 2	Burnaby	0.173	0.00511	0.00084	-	-
Zone 3	Surrey	0.280	0.00510	0.00143	-	-
Zone 4	Kamloops	0.117	0.00625	0.00073	-	-
Zone 5	Cranbrook	0.186	0.00667	0.00124	-	-
Total	-	1.000	-	0.00546	0.48430	0.36091

5.15 Carbon Dioxide Reductions

Terasen assumes an emissions factor of 50 tonnes carbon dioxide (CO_2) per terajoule of energy saved. Using this factor allows the saving estimates to be translated into the equivalent reduction in CO_2 emissions (Exhibit 97). In total, the program reduced the amount of annual CO_2 emitted by residential furnaces by 4.435 kilotonnes in the first 2.3 years, and 3.305 kilotonnes for subsequent years.

Exhibit 97: Reduction in Carbon Dioxide Emissions

	Net Savings (TJ)	Emissions Factor	$C0_2$ Reduction (Kilotonnes)
Direct	66.1	0.050	3.305
Spillover	22.6	0.050	1.130
Total – first 2.3 years	88.7	0.050	4.435
Total – Remaining Years	66.1	0.050	3.305

6 Summary & Conclusions

Summary comments and conclusions for the evaluation of Terasen's 2005-07 Heating System Upgrade Program are organized by the five main evaluation objectives.

Objective 1: Assess the reasons for program participation, the effectiveness of program marketing / advertising, free ridership, reasons for non-participation, and overall customer and trade ally satisfaction with the program.

Understanding the importance of Terasen's Heating System Upgrade Program to the decision to install a high efficiency rather than a standard or mid-efficiency furnace is essential to the attribution of energy savings to Terasen's program. In this regard, 57% of participants in the Terasen program credited the program with influencing their decision to purchase a high efficiency furnace, meaning that 43% of participants were free-riders and would have selected a high efficiency furnace without the incentive. The free rider estimate is consistent with the fact that 38% of non-participants that were unaware of the Terasen program installed a high efficiency furnace. Based on information provided by participants, the proportion of free riders for the 2005-07 program is estimated at 43%. This is an increase from 28% estimated for the previous program. The increase is consistent with the continuing transformation of the furnace market to high efficiency units.

Thirty percent (30%) of participants credited the program and its incentives for their decision to replace their furnace, on average, 2.3 years earlier than planned. This is consistent with the significantly higher proportion of participants than non-participants reporting that their old furnace was still operational at the time of replacement (91% versus 71%).

Satisfaction scores assigned to various program attributes by program participants, based on a five-point satisfaction scale, were generally favourable, with the highest score given to application procedures (4.1) and the lowest score given to size of the rebate (3.7). Trade allies also rated the program positively using the same five-point scale with the highest satisfaction score given to the types and number of furnaces eligible for a rebate (4.2), and the lowest score given to the size of the rebate (3.6).

Participants in the program attributed their awareness of the program to an insert in their Terasen bill (29% of participants), heating or furnace contractor (26%), word of mouth (21%), and direct mail from Terasen (15%). Success in program marketing is often reflected in word of mouth traffic. The Terasen program appears to have successfully achieved this result.

More than half (52%) of Terasen's residential customers who replaced their furnaces during the past three years and did not participate in the Terasen program were simply unaware the program existed. The next most common reasons for not participating (mentioned by anywhere from 17% to 19% of non-participants) included the dollar amount of the rebate (i.e., too small), the hassle factor with applying for the rebate, and the fact that the furnace they chose did not qualify. Ten percent (10%) of non-participants indicated they had applied to the program but had their application rejected.

Participants in Terasen's Heating System Upgrade Program are generally very satisfied with their high efficiency furnace. Ten percent (10%) reported experiencing problems with their new furnace, but only 2% reported having major repairs. A large percentage (71%) of participants reported improvements in the comfort of the home after installing their high efficiency furnace. In contrast, 42% of non-participants reported improvements in home comfort after installing their furnace.

Customers installing VSM-equipped furnaces were significantly more likely than those installing PSC-equipped furnaces to experience an increase in home comfort (68% versus 43% respectively).

***Objective 2: Assess program impact on sales of qualifying high-efficiency furnaces (HEF), and variable speed blower motors (VSM), for both participating and non-participating customers*.**

Information provided by customers and trade allies during the 2004 and 2007 furnace evaluations confirms that the replacement furnace market in British Columbia is moving towards high efficiency furnaces. Trade allies reported that high efficiency furnaces represented 48% of all replacement furnace sales prior to the launch of the most recent program. This share rose to 65% during the program and then declined to 56% after rebates ended in March 2007. VSM-equipped furnaces (either mid- or high efficiency) accounted for 34% of all furnace sales prior to program launch, and 44% following the program conclusion. Trade allies reported the share rising to 56% while the program was in operation.

Forty-three percent (43%) of non-participants reported installing high efficiency furnaces, while 39% installed standard or mid-efficiency furnaces. The remaining 13% of non-participants were not sure of their furnaces' efficiency. The decision not to install a high efficiency model was influenced by first cost, length of payback period, and a general lack of awareness of the relative costs and benefits of high efficiency furnaces. Non-participants were more likely than participants to have annual household incomes of less than $40,000, meaning that the relatively higher cost of a high efficiency furnace (approximately $700 more than a mid-efficiency furnace) was more of a financial hurtle for these households.

The top three reasons for installing a furnace equipped with a variable speed motor were the desire to save electricity (mentioned by 42% of participants), the contractor's recommendation (35%), and the $100 incentive offered by Terasen and its partners (11%). Trade allies were somewhat less likely than customers to attribute the decision to purchase a VSM-equipped furnace to the influence of the rebate (53% versus 57%). The customer-based estimate of free riders was used in the analysis of program impact.

Objective 3: Document and assess program impact on furnace and secondary heating operating behaviours that affect energy use, with particular emphasis on hours of operation.

Four factors influencing furnace operating costs (and savings) were explored in this evaluation – changes in furnace fan operating behaviours, changes in thermostat setting, changes in operating settings, and changes in supplementary heating.

How homeowners use their furnace to heat or cool the house, or to provide ventilation either occasionally or continuously before and after the installation of a VSM-equipped furnace affects the amount of electricity savings realized from the VSM blower motor. The economics of VSM furnace fans depend on operating hours – low operating hours significantly increases the payback period for VSM-equipped furnaces.

This evaluation found that, regardless of the furnace blower type, the number of households using their furnaces to intermittently heat or cool their homes during the heating/cooling seasons declined after installing their new furnace, and a proportion increased their use of the fans to provide continuous heat or cooling during the heating / cooling seasons. The data is inconclusive as to the influence of blower motor choice on behaviours as a significant proportion of households installing furnaces equipped with PSC motors also changed their usage to one of providing more continuous heat or cooling, or to provide ventilation for part of the year . Households that installed VSM-equipped furnaces, however, were more likely to use their fans continuously.

The evaluation found that households who replaced their old PSC-equipped furnaces with a VSM-equipped furnace are comprised of several user types – with no conclusive evidence to suggest that households that used their old furnaces either continuously for heating/ cooling, continuously, or to provide ventilation were predisposed to purchase a VSM-equipped furnace. Instead, energy efficiency, the recommendation of the contractor, and non-energy benefits (e.g., improved comfort, improved air quality via air circulation, pollen filters, etc.) appear to have been more important considerations. Interestingly enough, some households purchasing VSM-equipped furnaces appear to have had unrealistic expectations regarding the electricity savings potential of VSM blowers, as they rated their satisfaction with electricity bill savings from their VSM-equipped furnaces significantly lower than households who purchased PSC-equipped furnaces (3.8 versus 4.2 using a five-point satisfaction scale). Data on furnace fan operating behaviours prior to furnace change out suggest that a significant number of households installing VSM-equipped furnaces tended to use their old furnace fans only intermittently, implying their electricity bill savings would be less significant that those who operated the fans more frequently or continuously.

Changes to Furnace Thermostat Setting

Only 4% of participants and 11% of non-participants increased their thermostat setting to keep their house warmer since installing their new furnace. A significantly greater proportion of participants than non-participants reported turning down the thermostat since replacing their furnace (22% versus 9%). When increases or decreases in temperature (in degrees Celsius) are added to those who reported no change, the net change in indoor temperature for participants was minus 0.6 degrees Celsius compared to plus 0.4 degrees for non-participants. This suggests that participants are maintaining their home temperatures a full degree lower than non-participants, effectively adding to the energy savings attributable to participation in the Terasen program.

Changes to Furnace Operating Settings

Only 5% of participants and 1% of non-participants reported changing one or more operating settings. Participants mentioned changing the furnace to run less frequently, resetting the blower, installing a digital readout, and installing air conditioning. The non-participant reported adjusting the timing of the second stage burner so that it engaged sooner.

Changes to Supplementary Heating

The evaluation found that participants were significantly more likely than non-participants to reduce their use of supplemental heating after replacing their furnace (-16% versus -2%). This suggests that participants' new furnaces are picking up some of the heating load previously met through supplemental sources, most notably the natural gas fireplaces, and to a lesser degree, electric heaters. The transfer of the heating load to the new furnace may result in additional savings as the furnace will be more efficient than the natural gas fireplace. However this may be partially offset if supplementary heating in the pre-furnace change-out period was being used to improve the comfort in the home or parts of the home (e.g., temperature variations between rooms, temperature fluctuations between furnace cycles, etc.). The forthcoming refinement of program savings using a billing analysis will, by its nature, capture these changes in supplementary heating use and the net impact of other changes in heating/cooling use.

Objective 4: Determine the status of market transformation for high efficiency furnaces, and furnaces with variable speed drive blower motors in the British Columbia market.

Market transformation is measured, in part, by changes in market shares of high efficiency products, and declines in the relative price differential of high efficiency units relative to standard efficiency units.

High efficiency furnaces' share of the replacement furnace market rose from 48% prior to program launch to 65% during the program phase, before retreating to 56% after the conclusion of the program. A review of market share data from the past and present evaluations suggests a moderate pullback in the market when no program is in place.

Trade allies reported that 54% of all furnaces replaced between September 2005 and March 2007 were eligible for a rebate from Terasen Gas or its partners.

Trade allies reported that the share of the replacement furnace market represented by VSM-equipped furnaces increased from 34% in the pre-program period to 56% during the program, and then falling to 44% in the post-program period. Terasen's program records indicate that 65% of participants in the heating upgrade program installed a high efficiency furnace equipped with a VSM blower motor. A review of historical market share data suggests that like high efficiency furnaces, VSM market shares seesaw when programs are in effect versus when they are not, although the general trend is upward.

A comparison of equipment and installation costs provided by trade allies surveyed in 2003 and 2007 suggests that equipment prices for all furnace models regardless of efficiency increased over the four-year period, while installation costs either stayed the same or declined somewhat. High efficiency furnaces still cost more on an installed basis than mid- or standard efficiency units. The incremental cost of installing a 75,000 BTU/hour high efficiency furnace compared to a 90,000 BTU/hour mid-efficiency furnace (comparable in output based on efficiency) is $696, down from $877 in 2002, but up somewhat from $608 in 2003.

Objective 5: Develop preliminary estimates of program impact on natural gas sales and carbon dioxide emissions.

Energy savings attributable to Terasen's 2005-07 residential Heating System Upgrade Program, using a net to gross ratio 0.57, include 66.1 terajoules (TJ) in annual savings, plus an additional 22.6 TJ of savings for the first 2.3 years (spillover). Estimated peak day savings are 0.48430 TJ for the first 2.3 years, and then 0.36091 TJ for the remaining years. Assuming an emissions factor of 50 tonnes carbon dioxide per terajoule of energy saved, Terasen is credited with reducing CO^2 emissions from residential furnaces by 4.435 kilotonnes in the first 2.3 years, and 3.305 kilotonnes for subsequent years.

7 Bibliography

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Appendix A

Customer Survey:
Participants & Non-Participants

Terasen Gas
High Efficiency Furnace Rebate Program Evaluation
Customer Survey

Participant ____ (2006, Jan-Mar 2007)
VSM ___ No VSM ___

Non-Participant ____ (2005, 2006, Jan-Mar 2007)
Rejected Applicant ____
Account Number ____

INTRODUCTION

Hello, my name is __________ from Call Us Info, a marketing research firm. Today I am calling on behalf of Terasen Gas.

The purpose of my call is to collect information that will help Terasen Gas evaluate its efforts to improve the efficiency of home heating systems in BC. I would like to speak to the person responsible for decisions related to your natural gas furnace. Would that person be you?

Yes: CONTINUE
No: ASK TO SPEAK TO THE PERSON RESPONSIBLE FOR DECISIONS RELATED TO THE NATURAL GAS FURNACE. IF NOT AVAILABLE, ASK WHEN IS A BETTER TIME TO CALL BACK. RECORD TIME

Would you be willing to participate in a survey that should take less than 15 minutes of your time?

Yes: CONTINUE
No: ASK IF THERE IS A BETTER TIME TO CALL BACK. RECORD TIME
THANK AND TERMINATE

IF NECESSARY: If respondent would like to verify the legitimacy of this study, they can contact Terasen Gas at 604-576-7000 and advise that they would like to verify a market research study.

PARTICIPANTS:
Did you purchase and install a new natural gas furnace in your home in 2006 or during the first three months of 2007?

IF PARTICIPANT INDICATES NO, THEN RECORD CLIENT ID, THANK AND TERMINATE.

NON PARTICIPANTS:
Did you purchase and install a new natural gas furnace in your home in 2005, 2006, or the first three months of 2007?

Yes: CONTINUE
No: THANK AND TERMINATE

Do you rent or own your home?

Own: CONTINUE

Rent: THANK AND TERMINATE

Q1: Just to confirm, in which month and year did you have the new natural gas furnace installed?

Month _____ Year _____
DK _____

Q2: How old was the old furnace when it was replaced?

Years _____
DK _____

Q2a: Did you receive an incentive from Terasen Gas on the purchase of the new furnace?

Yes _____
No _____
DK _____

IF PARTICIPANT INDICATES NO, THEN RECORD CLIENT ID, THANK AND TERMINATE.

YES: NON PARTICIPANTS FORCE TO PARTICIPANTS

Q3: Was the old furnace still working and producing heat at the time it was replaced?

Yes _____
No _____
DK _____

Now I would like to ask about the efficiency of your new furnace.

- A high efficiency furnace has a minimum efficiency of 90% or more. It is characterized by venting the exhaust through the side of the house rather than through the roof. High efficiency furnaces are usually designated as ENERGY STAR qualified.
- A standard efficiency furnace has an efficiency rating of between 55% and 85%. It is characterized by venting the exhaust through the roof in a flue or chimney.

Q4: Is the new furnace a standard efficiency or a high efficiency unit?

(Note to interviewer, some respondents may refer to a standard efficiency furnace as a mid-efficiency unit). (IF RESPONDENT IS PROGRAM PARTICIPANT THE ANSWER SHOULD AUTOMATICALLY BE HIGH EFFICIENCY. IF NOT PROBE by reviewing the definitions of standard and high efficiency furnace.)

Standard efficiency _____
High efficiency _____
DK _____

Q5: Was the old furnace that was replaced a standard efficiency furnace or a high efficiency furnace?

Standard efficiency _____
High efficiency _____

DK ______

Q6: How satisfied are you with your choice of new furnace? (READ)

Extremely satisfied ____
Very satisfied ____
Somewhat satisfied ____
Not very satisfied ____
Not at all satisfied ____
DK ____

If Extremely / very / somewhat: SKIP TO Q8

Q7: Why are you not satisfied with your choice of furnace?

(SPECIFY) _______

PARTICIPANTS WITH Variable Speed Motors (VSM=1) SKIP TO Q9

Q8: Does your new furnace have a variable speed fan motor? Furnaces equipped with these motors use less electricity but typically cost more than furnaces with standard motors. They can operate over a range of speeds when providing heat or circulating air. (NOTE: standard furnace motors (called PSC motors) typically operate at only one or two fixed speeds).

Yes: _____
No: _____
DK: _____

Yes: CONTINUE WITH Q10a
No: SKIP TO Q11a
DK: SKIP TO Q13

Q9: Unused

IF PARTICIPANT with VSM=1, READ: Our records show that you selected a furnace with a variable speed drive motor.

Q10a: Why did you select a model with a variable speed furnace motor? (DO NOT READ – CHECK ALL THAT APPLY)

It is more energy-efficient ____
It is quieter ____
It can operate through a range of speeds ____
It provides more comfortable ventilation ____
I wanted better indoor air quality ____
It keeps my house warmer ____
It provides even heat ____
I wanted to have continuous ventilation ____
The contractor recommended it ____
I was motivated by the $100 rebate ____
Part of the better furnace I wanted ____

Other (RECORD) ____

Q11a: Prior to installing this furnace, were you aware of, or were you considering, the purchase of, a variable speed furnace motor?

Aware of: _____
Considering purchase: _____
No: _____
DK: _____

NO/NOT AWARE/DK: SKIP TO Q13a

Q11b: How did you become aware of a variable speed furnace motor? (DO NOT READ – CHECK ALL THAT APPLY)

Contractor ____
Terasen Gas ____
BC Hydro ____
Power Smart ____
Other (RECORD) ____

IF Q8=YES/DK/BLANK SKIP TO Q13a

Q12: Why did you not select a furnace model with a variable speed motor (DO NOT READ)?

Was unaware of the variable speed motor ____
Was unaware of the rebate for the variable speed motor ____
Furnace with variable speed motor was too expensive ____
Variable speed motor not available on furnace I chose ____
Contractor did not recommend it ____
Other (RECORD) ____

Q13a: Now we would like to understand how you use your furnace fan.
How did your furnace fan, if any, operate before the furnace change? (READ CHOICES BEFORE GETTING ANSWER)

Intermittently when providing heat ____
Continuously during the heating season ____
Intermittently when providing heat or air conditioning ____
Continuously during the heating / cooling seasons ____
Intermittently to also provide ventilation for part of the year ____
Continuously ____
No furnace fan (boiler) ____
DK ____

IF "Intermittently to also provide ventilation for part of the year"
Q13b: Approximately how many months per year did you operate the fan in this way? RECORD _____

Q13c: How does your furnace fan, if any, operate after the furnace change? (READ CHOICES BEFORE GETTING ANSWER)

Intermittently when providing heat ____
Continuously during the heating season ____
Intermittently when providing heat and air conditioning ____
Continuously during the heating / cooling seasons ____
Intermittently to also provide ventilation for part of the year ____
Continuously ____
No furnace fan (boiler) ____
DK ____

IF "Intermittently to also provide ventilation for part of the year"
Q13d: Approximately how many months per year do you plan to operate the fan in this way?
RECORD ____

Q13e: Thinking of the winter months only, have you set the thermostat to keep your house warmer, cooler, or the same than before the furnace change?

Warmer ____
Cooler ____
Neither (The Same) ____
Too soon to know ____
DK ____

IF "THE SAME" SKIP TO Q13f

Q13e – 1: If warmer/cooler – On average, how many degrees warmer/cooler do you keep your house during the winter compared to before you changed your furnace.(NOTE: CONFIRM UNITS – CELCIUS OR FARHENHEIT)
____° Celsius
____° Fahrenheit

Q13f: Other than adjusting the thermostat, have you changed any operating settings on your furnace since it was installed? (PROMPT: For example: changed when or how long the blower fan operates…)

Yes: _____
No: _____
DK: _____

Q13g: If Yes: What operating settings did you change? ___________________________

Q13h: Why did you make this change? ___________________________

Q14a: Are you familiar with the ENERGY STAR label for natural gas furnaces? Only furnaces that meet a high level of energy efficiency can qualify for ENERGY STAR.

Yes: _____
No: _____
DK: _____

Yes: CONTINUE WITH Q14
No/DK: SKIP TO Q16

Q14b: Was your furnace identified with an ENERGY STAR symbol on the furnace or the furnace brochure?

Yes: _____
No: _____
DK: _____

NON-PARTICIPANTS: SKIP TO Q16

Q15: On a scale of 1 to 5 where 1 is not at all important and 5 is very important, how important is it to you that the Terasen Gas incentive program included products that met the Energy Star high efficiency levels?

1 2 3 4 5 DK

Q16: What was the installed price of the new furnace, including any applicable taxes? (PROMPT IF NECESSARY: AN ESTIMATE IS OK)

Price: $ _____
DK: _____

Q17a: NON-PARTICIPANTS: Were you aware of the Terasen Gas program which offered an incentive for the purchase of a high efficiency ENERGY STAR qualified natural gas furnace?

Yes ____
No ____
DK ____

Yes: CONTINUE WITH Q17a-1
No/DK: SKIP TO Q29

Q17a-1: NON-PARTICIPANTS: Why did you not participate in the Terasen program? (DO NOT READ – CHECK ALL THAT APPLY)

Furnace did not qualify for rebate ____
Had planned to / didn’t get around to it ____
Not worth the effort / Didn’t want to bother ____
Rebate too small ____
Didn’t know how to apply ____
Tried to – rebate application was rejected ____
Contractor was not registered with program ____
Other (SPECIFY) _____________ ____

SKIP ALL REMAINING NON-PARTICIPANTS TO Q29

Now I would like to obtain your opinion on the Terasen Gas incentive program.

Q17b: How did you become aware of the incentive program? (DO NOT READ - CHECK ALL THAT APPLY)

Insert in Terasen Gas bill ____
Direct mail from Terasen Gas ____
Terasen Gas Web site ____
Radio advertisement ____
TV advertisement ____
Newspaper or magazine advertisement ____
Through heating or furnace contractor ____
Word of mouth ____
Natural Resource Canada Web site ____
Trade shows and consumer events ____

Other Websites ____
Other (list) ____

Q18a: What did you like about the promotion?

Like (LIST) ____________________________
DK ____

Q18b: What did you least like about the promotion?

Dislike (LIST)____________________________
DK ____

Q19. Unused

NON-PARTICIPANTS: SKIP TO Q29

Q20: On a scale of one to five, where one is not at all important and five is very important, how important was the Terasen Gas incentive in your choice of a high efficiency furnace?

1 2 3 4 5 DK

ASK Q27 ONLY OF PARTICIPANTS WITH VSM=1 FROM SCREENER

Q27: Our records show that you received an additional incentive for purchasing a high efficiency furnace with a variable speed blower motor. On a scale of one to five, where one is not at all important and five is very important, how important was this additional incentive to your choice of furnace that came with a variable speed blower motor?

1 2 3 4 5 DK

Q28 Unused

Q29: Did you receive a manufacturers' offer or rebate on the purchase of this furnace?

Yes ______
No ______
DK ______

Yes: CONTINUE WITH Q30
No/DK: SKIP TO QUESTION 31

Q30: What was the dollar value of the manufacturers' rebate and offer you received?

Amount $ _____
DK _____

NON-PARTICIPANTS SKIP TO Q36

Q31: On a scale of one to five, where one is not at all satisfied, and five is very satisfied, how satisfied were you with the following aspects of the rebate program? (ROTATE)

Information on the rebate	1 2 3 4 5 DK
Number or type of furnaces eligible for the rebate	1 2 3 4 5 DK
Application procedures to obtain the rebate	1 2 3 4 5 DK
Amount of the rebate	1 2 3 4 5 DK
Information about efficient furnaces	1 2 3 4 5 DK

Q32: Did you call Terasen Gas' customer call center about this program?

Yes ____
No ____
DK ____

NO/ DK: GO TO Q34

Q33: What was the purpose of this call? DO NOT READ, CHECK ALL THAT APPLY?

To clarify my eligibility for the incentive ____
To determine if the furnace was eligible for the rebate(s) ____
To understand the rebate ____
Other (LIST) ________________________________

Q34: Did you replace the furnace earlier than planned because of the availability of the rebate?

Yes ____
No ____
DK ____

Yes: CONTINUE WITH Q35
No/DK: SKIP TO Q36

Q35: How many years earlier than planned did you replace the furnace because of the availability of the rebate?

Years _____
DK _____

Q36: What is the approximate capacity of your new furnace in BTUs per hour?

Record response ______ BTU per hour
DK ______

Q37: We would like to understand how satisfied you are with various aspects of your new furnace. On a scale of one to five, where one is not at all satisfied and five is very satisfied, how satisfied are you with the following? (ROTATE)

The price of your furnace	1 2 3 4 5 DK
The reliability of your furnace	1 2 3 4 5 DK
Natural gas consumption of your furnace	1 2 3 4 5 DK
Ease of installation of your furnace	1 2 3 4 5 DK
After sales service for your furnace	1 2 3 4 5 DK
Amount of your natural gas bill after installing the furnace.	1 2 3 4 5 DK
Amount of your electricity bill after installing the furnace.	1 2 3 4 5 DK

Q38: Have you had any problems with your new furnace?

YES: CONTINUE WITH Q39:
NO: SKIP TO Q40

Q39: What problems have you experienced (DO NOT READ – CHECK ALL THAT APPLY)

Furnace cycles off and on too frequently
Furnace has required major repairs
Difficult to maintain the right temperature
Furnace is too noisy
Furnace has excessive vibration
Furnace produces an uncomfortable draft
Furnace size is too small
OTHER (SPECIFY) _____________

Q40: Since the new furnace was installed, has the comfort level of your house increased, decreased or remained the same?

INCREASED	GO TO Q41
DECREASED	GO TO Q42
REMAINED THE SAME	GO TO Q43

Q41: In what way has the comfort increased (DO NOT READ – CHECK ALL THAT APPLY)?

More even temperatures between the rooms _____
Rooms that were previously cold are warmer _____
Indoor air quality has improved _____
House more comfortable _____
House warmer now _____
Quiet operation of fan / less noise _____
Other (RECORD) ______________________________

GO TO Q43

Q42: In what way has the comfort decreased (DO NOT READ – CHECK ALL THAT APPLY)?

Noise level increased ____
Cool drafts ____
Other (RECORD ______________________________

Q43: On a scale of 1 to 5, where 1 is not at all important and 5 is very important, please rate the following attributes in terms of their influence on your choice of your home heating system. (ROTATE)

Comfort in your home	1 2 3 4 5 DK
Indoor air quality	1 2 3 4 5 DK
Energy efficiency	1 2 3 4 5 DK
Initial cost of the system	1 2 3 4 5 DK
Operating cost of the system (ie: fuel cost)	1 2 3 4 5 DK
Both initial cost and operating costs	1 2 3 4 5 DK

Q44-46 Unused

Q47: Other than the furnace, does your house have an "other" or supplementary source of heating?

Yes _____
No _____
DK _____

No / DK GO TO Q51:

Q48: What heating fuel is used for the "other" or supplementary heating? (CHECK ALL THAT APPLY)

Natural gas ____
Electricity ____
Propane ____
Wood ____
Oil ____

Q48a: What space heating method is used for the "other" or supplementary heating? (CHECK ALL THAT APPLY)

Electric baseboard heaters ____
Portable electric heaters ____
Heat pump ____
Fireplace ____
Wood stove ____
Central forced air furnace ____
Hot water baseboards ____
Hot water in floor radiant ____
Radiant electric cables ____
Natural gas wall heater ____
Other (LIST) ____

Q49: Has your use of the supplementary heating increased, decreased or remained the same since the installation of the new furnace?

Increased: GO TO Q50a
Decreased: GO TO Q50b
Remained the same: GO TO Q51
DK: GO TO Q51

Q50a: By about how much has your use of the supplementary heating increased? (READ)

0 – 24% ____
25 – 49% ____
50 – 74% ____
75 – 100% ____
DK ____

GO TO: Q51

Q50b: By about how much has your use of the supplementary heating decreased? (READ)

0 – 24% ____
25 – 49% ____
50 – 74% ____
75 – 100% ____
DK ____

Q51: In the past two years (NON-PARTICIPANTS READ 3 years) have you made any significant changes to your house that would affect natural gas usage?

YES: Go to Q51a
NO: Go to Q52

Q51a: What are the changes that you have made to your house? (DO NOT READ – CHECK ALL THAT APPLY)

Addition to the size of the house ____
If addition: Approximately how big was the addition ___sq ft
___sq meters
Added natural gas furnace as the main heat source for house ____
Added electric heat pump ____
Removed electric heat pump ____
Installed additional ceiling or wall insulation ____
Caulked or weather stripped drafty exterior surfaces ____
Installed new double or triple glazed windows ____
Installed new low E windows ____
Installed a new high efficiency hot water heater ____
Other (SPECIFY) ____

The final questions are for classification purposes only and are completely confidential, as are all your answers.

Q52: What type of home do you live in?

Single detached ______
Semi-detached (duplex) ______
Apartment/condominium ______
Row/townhouse ______
Mobile home or other ______
DK ______

Q53: How old is your home?

Years ______
DK ______

Q54: What is the approximate heated area of your home in square feet or square meters?

Square feet ______
Square meters ______
DK ______

Q55: Do you use natural gas for any of the following ?
READ – IF NOT APPLICABLE RECORD AS "NO"

Main space heating	Yes/No/DK
Secondary space heating	Yes/No/DK
Fireplace insert	Yes/No/DK
Water heating	Yes/No/DK
Clothes drying	Yes/No/DK
Indoor pool heating	Yes/No/DK
Outdoor pool heating	Yes/No/DK
Hot tub	Yes/No/DK
Cooking	Yes/No/DK
Barbeque	Yes/No/DK
Patio heater	Yes/No/DK

Q56: Into which of the following age categories do you fit? (READ CATEGORIES)

Less than 19 years ______
19-24 years ______
25-34 years ______
35-44 years ______
45-54 years ______
55-64 years ______
65 years and older ______
Prefer not to answer ______

Q57: What is your marital status? (READ CATEGORIES)

Single _______
Married/common law _______

Divorced/separated ______
Widowed ______
Prefer not to answer ______

Q58: How many people, including yourself, are currently living in your household (please include any boarders or renters who do not have a separate natural gas account)?

_____ number

Q59: Please indicate the number of occupants by age categories. (READ CATEGORIES)

0-18 years _____
19-24 years _____
25-34 years _____
35-44 years _____
45-54 years _____
55-64 years _____
65 years and older _____
Prefer not to answer _____

Q60: What is the highest level of education you have completed? (READ CATEGORIES)

Some high school _____
Completed high school _____
Some university/college _____
Completed university/college _____
Some trade/technical school _____
Completed trade/technical school _____
Post graduate _____
Prefer not to answer _____

Q61: What was your total annual household income before taxes in 2006? (READ CATEGORIES)

Less than $20,000 _____
$20,000 to $39,999 _____
$40,000 to $59,999 _____
$60,000 to $79,999 _____
$80,000 to $99,999 _____
$100,000 to $124,999 _____
Over $125,000 _____
Prefer not to answer _____

Q62: What are the first three digits of your postal code?

Response __ __ ___
DK _____

Q63: In order to better understand how customers use natural gas, we would like to link your survey responses to your natural gas usage information. This information will be used only for statistical information and will not identify you as an individual. Do we have your permission to link your survey responses to your natural gas usage data?

Yes ____
No ____
DK ____

PROMPT IF NECESSARY: THE OBJECTIVE OF THIS PROJECT IS TO ASSIST TERASEN GAS IN DETERMINING THE ACTUAL REDUCTION IN NATURAL GAS USAGE ASSOCIATED WITH EFFICIENT FURNACES. THIS IS DONE BY COMPARING YOUR NATURAL GAS CONSUMPTION BEFORE AND AFTER THE INSTALLATION OF THE EFFICIENT FURNACE.

Terasen Gas, and Call Us would like to thank you for your help and assistance.

Appendix B

Trade Ally Survey

Furnace Dealers, Contractors, Installers

Terasen Gas
High Efficiency Furnace Rebate Program Evaluation
Trade Ally Survey

INTRODUCTION

Hello, my name is __________ from Call Us Info, a market research firm. Today I am calling on behalf of Terasen Gas. I would like to speak to the person responsible for residential furnace sales and installation with your firm.

Available: CONTINUE
Not available: ASK WHEN IS A BETTER TIME TO CALL BACK. RECORD TIME.

The purpose of my call is to collect information that will help Terasen Gas improve the efficiency of home heating systems in BC. We will use this information to better understand the impact of more efficient furnaces on natural gas consumption in B.C. and the effectiveness of our promotion programs. Would you be willing to participate in a survey that will take less than 15 minutes of your time?

Yes: CONTINUE
No: ASK IF THERE IS A BETTER TIME TO CALL BACK. RECORD TIME.

IF NECESSARY: If respondent would like to verify the legitimacy of this study, they can contact Terasen Gas at 604-576-7000 and advise that they would like to verify a market research study.

I understand that your firm provides contracting and installation services for replacement natural gas furnaces in BC. Is that correct?

Yes: CONTINUE
No: SEEK CLARIFICATION AND CONTINUE IF FIRM PROVIDES EITHER CONTRACTING OR INSTALLATION SERVICES FOR NATURAL GAS FURNACES. IF NOT, THANK AND TERMINATE

Q1: About what percentage of your furnace sales and installations involve new residential dwellings and what percentage involves replacement furnaces?

New dwellings _____%
Replacements _____%
DK _____

Q2: We are interested in understanding the role of high efficiency furnaces in the market in BC and the impact of Terasen Gas' High Efficiency Furnace program. High efficiency furnaces have a AFUE rating of 90% or better. Terasen's furnace program ran from October 2005 to the end of March 2007.

About what percentage of your replacement furnace sales and installations were high efficiency before, during and since the program terminated at the end of March 2007? (PROBE: IF THE RESPONDENT SAYS "DON'T KNOW" INDICATE THAT AN ESTIMATE IS ALL WE ARE LOOKING FOR)

Before Program _____%
During Program_____%
After Program _____%
DK _____

Q3: We are also interested in the impact of the program on the sale of furnaces with variable speed blower motors. These motors may also be referred to as “ECM” motors. About what percentage of your furnace replacement sales and installations before, during and after the Terasen program included variable speed blower motors? (PROBE: IF THE RESPONDENT SAYS “DON’T KNOW” INDICATE THAT AN ESTIMATE IS ALL WE ARE LOOKING FOR)

Before Program _____%
During Program_____%
After Program _____%
DK _____

Q4: Unused

Now we would like to understand if the Terasen Gas incentive program encouraged customers to replace furnaces earlier than they would otherwise do so.

Q5a: About what percentage of the furnaces you replaced between October 2005 and March 2007 were eligible for a rebate from Terasen Gas or its partners?

Percentage ____ %
DK ____

Q6: What was the average remaining length of life of those furnaces that were replaced while still operational?

Years _____
DK _____

Q7: Do you routinely do a heat loss calculation when installing a replacement furnace?

Yes _____
No _____

No: SKIP TO Q9

Q8: What percentage of the time does doing the heating loss calculation lead to the choice of a smaller capacity furnace than you would have recommended if the heat loss calculation had not been done?

Percentage _____
DK _____

Q9: What would be a typical equipment price excluding taxes for a 90,000 BTU/hr input mid-efficiency natural gas replacement furnace?

Price ______

DK/NR ______
(NOTE TO INTERVIEWER, IF RESPONDENT DOES NOT HAVE A 90,000 BTU/HR INPUT PRODUCT, PLEASE ASK FOR THE INFORMATION REGARDING THE NEAREST SIZED FURNACE.)

Q10: What would be a typical installed price excluding taxes for a 90,000 BTU/hr input mid-efficiency natural gas replacement furnace?

Price ______
DK ______

Q11: What would be a typical equipment price excluding taxes for a 90,000 BTU/hr input high efficiency natural gas replacement furnace?

Price ______
DK/NR ______

Q12: What would be a typical installed price excluding taxes for a 90,000 BTU/hr input high efficiency natural gas replacement furnace?

Price ______
DK ______

Q13: What would be a typical equipment price excluding taxes for a 75,000 BTU/hr input high efficiency natural gas replacement furnace?

Price ______
DK/NR ______

Q14: What would be a typical installed price excluding taxes for a 75,000 BTU/hr input high efficiency natural gas replacement furnace?

Price ______
DK ______

Now I would like to obtain your opinion on the Terasen Gas incentive program which supported the installation of high efficiency furnaces and high efficiency variable speed fan motors. The program offered rebates for high efficiency furnaces from October 2005 to March 2007.

Q15: On a scale of one to five, where one is not at all satisfied, and five is very satisfied, how satisfied were you with the following aspects of the rebate program? (ROTATE)

Information on the rebate	1 2 3 4 5 DK
Types or numbers of furnaces eligible for the rebate	1 2 3 4 5 DK
Application procedures to obtain the rebate	1 2 3 4 5 DK
Amount of the rebate	1 2 3 4 5 DK

Q16: On a scale of one to five, where one is not at all important and five is very important, how important was the rebate in your customers' choice of furnace efficiency?

1 2 3 4 5 DK

Q17: Unused
Q18: Unused
Q19: Unused

Q20: The program included an additional incentive for the purchase of a furnace with an energy-efficient variable speed blower motor. On a scale of one to five, where one is not at all important and five is very important, how important was the $ 100 incentive in your customers' choice of furnace blower motor efficiency?

1 2 3 4 5 DK

Q21: Unused

Q22: Unused

Q23: Of the furnace models you sold while the program was in operation, what percentage had:
Single speed PSC blower motors ____%
Multi-speed PSC blower motors ____%
Variable speed blower motors ____%
DK ____

PROMPT IF NECESSARY: A PSC OR PERMANENT SPLIT CAPACITOR MOTOR REFERS TO A BLOWER MOTOR THAT TYPICALLY OPERATES AT ONE OR TWO SPEEDS BUT IS LESS EFFICIENT THAN VARIABLE SPEED MOTORS THAT CAN OPERATE THROUGH A BROAD RANGE OF SPEEDS. FURNACES EQUIPPED WITH PSC MOTORS ARE LESS EXPENSIVE THAN THOSE EQUIPPED WITH VARIABLE SPEED MOTORS.

PROMPT IF NECESSARY: THE TERASEN FURNACE PROGRAM WAS IN EFFECT FROM OCTOBER 2005 TO MARCH 2007.

Q24a: What percentage of the standard (mid) efficiency furnaces you sold during the program period had a variable speed motor?
____%

Q24b: What percentage of the high efficiency furnaces you sold during the program period had a variable speed motor?
____%

Q24d: What were the reasons why customers purchased a furnace with a variable speed blower motor? (DO NOT READ - SPECIFY ALL THAT APPLY)

It uses less electricity ____
It is quieter ____
It provides more comfortable ventilation ____
It can operate through a range of speeds ____
The $ 100 rebate ____
Customer wanted continuous ventilation___ ____
Customer wanted the "best" furnace ____
Contractor / sales person sold the feature ____
Came with the furnace that was ordered _______
Other (RECORD) ______________________

Q25: Are you familiar with the ENERGY STAR label for natural gas furnaces:

Yes: _____
No: _____
DK: _____

NO / DK: GO TO Q29.

Q26: Do you recommend ENERGY STAR natural gas furnaces to your customers?

Yes _____
No _____
Sometimes/depends on the customer _____
DK _____

Q27: Unused

Q28: Unused

Next we would like to understand your views of high efficiency furnaces.

Q29: Do you believe that high efficiency furnaces are the best choice for your customers?

Yes _____
No _____
Sometimes/depends on the customer _____
DK _____

Yes, no, sometimes/depends on the customer: CONTINUE WITH Q30
DK: SKIP TO Q31

Q30: Why do you say this?

Record response _____

Q31: Do you recommend variable speed blower motors to your customers?

Yes _____
No _____
Sometimes/depends on customer _____
DK _____

Yes, no, sometimes/depends on the customer: CONTINUE WITH Q32
DK: SKIP TO Q33

Q32: Why do you say this?

Record response _____

Q33: Do you recommend two-stage mid-efficiency furnaces to your customers as a preferred option to a high efficiency furnace?

Yes ______
No ______
Sometimes/depends on customer ______
DK ______

Yes, no, sometimes/depends on the customer: CONTINUE WITH Q34
DK: SKIP TO Q35

Q34: Why do you say this?

Record response ______

The next few questions are to help Terasen understand how their rebate program may have influenced how households operate their furnaces.

Q35: In what percentage of the furnaces that you replaced did the ventilation fans run:
(READ THE CATEGORIES BEFORE OBTAINING RESPONSES. ANSWERS SHOULD SUM TO 100%. IF NOT, REVIEW THE RESPONSES WITH THE RESPONDENT AND ADJUST ACCORDINGINGLY)

Intermittently when providing heat ____%
Continuously during the heating season ____%
Intermittently when providing heat and air conditioning ____%
Continuously during the heating and cooling seasons ____%
Intermittently to also provide ventilation for part of the year ____%
Continuously ____%
DK ______

Q36: In what percentage of all your installations of furnaces with PSC motors do the ventilation fans run: (READ THE CATEGORIES BEFORE OBTAINING RESPONSES. ANSWERS SHOULD SUM TO 100%. IF NOT, REVIEW THE RESPONSES WITH THE RESPONDENT AND ADJUST ACCORDINGINGLY)

Intermittently when providing heat ____%
Continuously during the heating season ____%
Intermittently when providing heat and air conditioning ____%
Continuously during the heating and cooling seasons ____%
Intermittently to also provide ventilation for part of the year ____%
Continuously ____%
DK ______

Q38: Thinking now of only those furnaces with variable speed motors, in what percentage of all your installations of furnaces with variable speed motors do the ventilation fans run: (READ THE CATEGORIES BEFORE OBTAINING RESPONSES. ANSWERS SHOULD SUM TO 100%. IF NOT, REVIEW THE RESPONSES WITH THE RESPONDENT AND ADJUST ACCORDINGINGLY)

Intermittently when providing heat ____%
Continuously during the heating season ____%
Intermittently when providing heat and air conditioning ____%
Continuously during the heating and cooling seasons ____%
Intermittently to also provide ventilation for part of the year ____%
Continuously ____%
DK _____

Q39: Do you believe that your customers have enough information to make an informed decision on their choice of furnace efficiency?

Yes _____
No _____
Sometimes/depends on customer _____
DK _____

No, sometimes/depends on the customer: CONTINUE WITH Q40
Yes / DK: SKIP TO Q41

Q40: What information are they missing when making a decision on the choice of furnace efficiency?
Record answer: __________

Q41: Do you believe that your customers have enough information to make an informed decision on whether to purchase a furnace with a PSC or variable speed furnace motor?

Yes _____
No _____
Sometimes/depends on customer _____
DK _____

No, sometimes/depends on the customer: CONTINUE WITH Q42
Yes / DK: SKIP TO Q43

Q42: What information are they missing when making a decision on the choice of furnace blower motor?
Record answer: __________

Q43 – Q47: Unused

Finally we have a few questions to help us classify the data.

Q48: How many employees are there in your firm?

Number _____
DK/NR _____

Q49: Which of the following categorization best describes your business?

Furnace Dealer and Heating Contractor ____

Independent Heating Contractor ____
Gas fitter ____
Other (RECORD) ____

Q50. Do you have any suggestions on how consumers could be encouraged to install higher efficiency rather than mid-efficiency furnaces?

Record answer _____

Q51: Do you have any suggestions on how consumers could be encouraged to install variable speed furnace blower motors rather than the less efficient PSC motors?

Record answer _____

Terasen Gas and Call Us would like to thank you for your help and for your assistance.

Appendix C

Preparation of Survey Samples

Appendix C
Preparation of Survey Samples

C.1 Survey Groups

Survey samples were developed for four different survey groups:

- Program participants
- Program non-participants
- Program declined non-participants (alternative source of non-participating customers)
- Trade allies (furnace dealers, contractors, installers)

C.1.1 Participants, Non-Participants, & Declined

Participant and declined lists were assembled from program records for the 2006-07. The list of non-participants was created by sampling the Energy Extracts provided by ABSU. The non-participant list was screened for customers showing up the 2005-2007 participant or declined lists, or on the 2002-2004 participant lists provided by ABSU. The regional breakdown of the non-participants matches that of the participants. Customers in the declined lists represented customers that submitted a rebate application but were denied due to furnace ineligibility, self-installation, or other reason. This list was prepared as an alternative list of non-participants if the non-participant sample was exhausted prior to achieving quota.

C.1.1.1 Pre-Weather Normalization Filters

For the participants and declined list, consumption information was collected based on the most recent 12 month period prior to the installation. For the non-participants, 36 months of consumption up to March 31, 2007 was obtained.

To improve the likelihood of a non-participant having replaced their furnace in the past three years, it was decided to remove any accounts where the premise was younger than 15 years (i.e., the average life of a furnace is approximately 15 years). This step was possible for the LML region but due to issues with the SupplyReqDate field in the Energy Extracts, only premises less than eight years old could be excluded in the other regions.

C.1.1.2 Weather Normalization & Other Billing History Filters

Using the bi-monthly meter reads (and associated consumption) and weather data, the average daily consumption per meter read, and the average daily HDD13 and HDD18 for that same period, are determined. The following regression model (1) was then run:

(1) Average Daily Consumption = $\beta_0 + (\beta_1 \text{ X } HDD_{13}) + (\beta_2 \text{ X } HDD_{18})$

The total HDD_{13}'s and HDD_{18}'s during a "normal" year (basically the average of the past ten years) were determined. Normalized annual consumption was then calculated using equation (2):

(2) Normal Consumption = $(365 \text{ X } \beta_0) + (\text{Total } HDD_{13}\text{'s X } \beta_1) + (\text{Total } HDD_{18}\text{'s X } \beta_2)$

Finally, the following elimination criteria (i.e., screens) were applied to generate finalized lists:

1. Remove all customers not in the same premise for at least one year prior to and after the installation date.
2. Remove all customers where the regressions give an R-Square value below 0.75. This ensures the remaining customers results reflect a good fit with the data, and their consumption is predictable.
3. Remove those customers where the heat slope coefficients (HDD_{13}, HDD_{18}) are negative. It is reasonable to expect that customers will consume more gas when the heating degree days increase. Negative heat slope coefficients suggests that consumption declines as heating degree days increase.
4. Remove all customers with annual consumption less than 30GJ. Customers with annual consumption less than 30GJ are unlikely to be using natural gas for space heating.
5. Remove customers where the EDF (Error Degrees of Freedom) is less than three. In effect, this removes customers with less than five meter reads.
6. Remove all customers with suspect meter reads. These include meter reads where the transaction period refers back to a date prior to the last read date output (i.e., the read date less the corresponding read days is before the last read date).
7. Remove all customers where consumption for one read date or more is zero. There should be at least six meter reads per a year's worth of consumption. One year of consumptions is the minimum acceptable time.
8. Remove all customers where the weather effect is more than two standard deviations away from the average weather effect. The weather effect is defined as:

   Weather Effect = (Normal Consumption – Actual Consumption) / Actual Consumption

   Since 96% of all data is within two standard deviations of the mean, this eliminates those with abnormally large weather effects (i.e., outliers).

C.2 Trade Allies

A list of 640 contractors who participated in the Heating System Upgrade Program was generated by matching contractor registration numbers from the application with the list of contractors registered with the British Columbia Safety Authority (BCSA). Access to this list was allowed under the Safety Standards Act Sec 21.

C.3 Summary

Exhibit 98 summarizes the starting sample sizes for the customer and trade ally surveys.

Exhibit 98: Starting Sample and Quota

Survey Group	Starting Sample	Survey Quota (n)
Trade Allies	640	50
Participants	4,268	100
Non-participants	33,277	100
Declined List	581	n/a

Appendix D

Expanded Tabulations

Appendix D
Expanded Tabulations

Exhibit D1: Customer Satisfaction with Various Program Components

	Information on the Rebate	Number or Types of Furnaces Available for Rebate	Application Procedures to Obtain the Rebate	Amount of the Rebate	Information about Efficient Furnaces
Base (n)	*200*	*100*	*100*	*40*	*120*
Not at all Satisfied (1)	2%	4%	1%	2%	3%
Not Very Satisfied (2)	4%	4%	5%	12%	4%
Somewhat Satisfied (3)	17%	18%	17%	20%	22%
Very Satisfied (4)	37%	24%	26%	30%	38%
Extremely Satisfied (5)	31%	27%	41%	26%	26%
DK/NR*	9%	23%	10%	10%	7%
Total	**100%**	**100%**	**100%**	**100%**	**100%**
Not Very or Not at all Satisfied	7%	10%	7%	16%	8%
Extremely or Very Satisfied	75%	66%	74%	62%	69%
Mean	***4.0***	***3.9***	***4.1***	***3.7***	***3.9***

Totals may not sum due to rounding
** excluded from calculation of mean satisfaction*

Exhibit D2: Customer Satisfaction with Various Furnace Attributes
Price of the Furnace

	Total	Participants	Non-Participants	PSC	VSM	Unknown Blower Motor Type
Base (n)	*200*	*100*	*100*	*40*	*120*	*40*
Not at all Satisfied (1)	1%	1%	-	-	1%	-
Not Very Satisfied (2)	6%	5%	7%	13%	5%	3%
Somewhat Satisfied (3)	20%	26%	14%	10%	23%	20%
Very Satisfied (4)	38%	38%	38%	45%	38%	30%
Extremely Satisfied (5)	28%	28%	28%	25%	28%	30%
DK/NR*	8%	2%	13%	8%	4%	18%
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
Not Very or Not at all Satisfied	7%	6%	7%	13%	6%	3%
Extremely or Very Satisfied	66%	66%	66%	70%	67%	60%
Mean	***3.9***	***3.9***	***4.0***	***3.9***	***3.9***	***4.1***

Totals may not sum due to rounding
** excluded from calculation of mean satisfaction*

Exhibit D3: Customer Satisfaction with Various Furnace Attributes
Reliability of Your Furnace

	Total	Participants	Non-Participants	PSC	VSM	Unknown Blower Motor Type
Base (n)	*200*	*100*	*100*	*40*	*120*	*40*
Not at all Satisfied (1)	1%	1%	-	-	1%	-
Not Very Satisfied (2)	2%	-	3%	8%	-	-
Somewhat Satisfied (3)	2%	1%	3%	3%	2%	3%
Very Satisfied (4)	27%	24%	30%	35%	23%	30%
Extremely Satisfied (5)	63%	66%	60%	55%	66%	63%
DK/NR*	6%	8%	4%	-	8%	5%
Total	**100%**	**100%**	**100%**	**100%**	**99%**	**100%**
Not Very or Not at all Satisfied	2%	1%	3%	8%	1%	0%
Extremely or Very Satisfied	90%	90%	90%	90%	89%	93%
Mean	***4.6***	***4.7***	***4.5***	***4.4***	***4.7***	***4.6***

Totals may not sum due to rounding
** excluded from calculation of mean satisfaction*

Exhibit D4: Customer Satisfaction with Various Furnace Attributes
Natural Gas Consumption of Your Furnace

	Total	Participants	Non-Participants	PSC	VSM	Unknown Blower Motor Type
Base (n)	*200*	*100*	*100*	*40*	*120*	*40*
Not at all Satisfied (1)	2%	3%	1%	-	3%	-
Not Very Satisfied (2)	2%	3%	1%	3%	2%	3%
Somewhat Satisfied (3)	13%	13%	12%	10%	14%	10%
Very Satisfied (4)	37%	32%	42%	50%	30%	45%
Extremely Satisfied (5)	36%	39%	33%	25%	40%	35%
DK/NR*	11%	10%	11%	13%	11%	8%
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
Not Very or Not at all Satisfied	4%	6%	2%	3%	5%	3%
Extremely or Very Satisfied	73%	71%	75%	75%	70%	80%
Mean	***4.2***	***4.1***	***4.2***	***4.1***	***4.1***	***4.2***

Totals may not sum due to rounding
** excluded from calculation of mean satisfaction*

Exhibit D5: Customer Satisfaction with Various Furnace Attributes
Ease of Installation

	Total	Participants	Non-Participants	PSC	VSM	Unknown Blower Motor Type
Base (n)	*200*	*100*	*100*	*40*	*120*	*40*
Not at all Satisfied (1)	2%	1%	2%	-	2%	3%
Not Very Satisfied (2)	3%	3%	3%	3%	2%	8%
Somewhat Satisfied (3)	5%	5%	5%	8%	4%	5%
Very Satisfied (4)	28%	27%	28%	35%	29%	15%
Extremely Satisfied (5)	48%	49%	47%	50%	48%	48%
DK/NR*	15%	15%	15%	5%	16%	23%
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
Not Very or Not at all Satisfied	5%	4%	5%	3%	3%	10%
Extremely or Very Satisfied	76%	76%	75%	85%	77%	63%
Mean	***4.4***	***4.4***	***4.4***	***4.4***	***4.4***	***4.3***

Totals may not sum due to rounding
** excluded from calculation of mean satisfaction*

Exhibit D6: Customer Satisfaction with Various Furnace Attributes
After Sales Service

	Total	Participants	Non-Participants	PSC	VSM	Unknown Blower Motor Type
Base (n)	*200*	*100*	*100*	*40*	*120*	*40*
Not at all Satisfied (1)	3%	3%	2%	3%	3%	-
Not Very Satisfied (2)	2%	2%	2%	-	3%	3%
Somewhat Satisfied (3)	9%	12%	6%	10%	8%	10%
Very Satisfied (4)	22%	17%	27%	38%	20%	13%
Extremely Satisfied (5)	39%	39%	39%	38%	38%	43%
DK/NR*	26%	27%	24%	13%	28%	33%
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
Not Very or Not at all Satisfied	5%	5%	4%	3%	6%	3%
Extremely or Very Satisfied	61%	56%	66%	75%	58%	55%
Mean	***4.2***	***4.2***	***4.3***	***4.2***	***4.2***	***4.4***

Totals may not sum due to rounding
** excluded from calculation of mean satisfaction*

Exhibit D7: Customer Satisfaction with Various Furnace Attributes
Amount of Your Natural Gas Bill after Installing the Furnace

	Total	Participants	Non-Participants	PSC	VSM	Unknown Blower Motor Type
Base (n)	*200*	*100*	*100*	*40*	*120*	*40*
Not at all Satisfied (1)	2%	3%	1%	3%	3%	-
Not Very Satisfied (2)	2%	3%	1%	3%	2%	3%
Somewhat Satisfied (3)	23%	26%	20%	28%	23%	20%
Very Satisfied (4)	26%	22%	29%	23%	24%	33%
Extremely Satisfied (5)	31%	30%	31%	23%	33%	30%
DK/NR*	17%	16%	18%	23%	16%	15%
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
Not Very or Not at all Satisfied	4%	6%	2%	5%	4%	3%
Extremely or Very Satisfied	56%	52%	60%	45%	58%	63%
Mean	***4.0***	***3.9***	***4.1***	***3.8***	***4.0***	***4.1***

Totals may not sum due to rounding
** excluded from calculation of mean satisfaction*

Exhibit D8: Customer Satisfaction with Various Furnace Attributes
Amount of Your Electricity Bill after Installing Your Furnace

	Total	Participants	Non-Participants	PSC	VSM	Unknown Blower Motor Type
Base (n)	*200*	*100*	*100*	*40*	*120*	*40*
Not at all Satisfied (1)	2%	3%	-	-	3%	-
Not Very Satisfied (2)	5%	3%	6%	5%	5%	3%
Somewhat Satisfied (3)	18%	23%	13%	10%	23%	10%
Very Satisfied (4)	25%	13%	36%	30%	19%	35%
Extremely Satisfied (5)	27%	28%	25%	35%	24%	25%
DK/NR*	25%	30%	20%	20%	26%	28%
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
Not Very or Not at all Satisfied	6%	6%	6%	5%	8%	3%
Extremely or Very Satisfied	51%	41%	61%	65%	43%	60%
Mean	***3.9***	***3.9***	***4.0***	***4.2***	***3.8***	***4.1***

Totals may not sum due to rounding
** excluded from calculation of mean satisfaction*

Exhibit D9: Importance of Attributes that Influenced Choice of Home Heating System Comfort in Your Home

	Total	Participants	Non-Participants
Base (n)	*200*	*100*	*100*
Not at all Important (1)	1%	1%	-
(2)	2%	2%	2%
(3)	12%	12%	12%
(4)	32%	31%	33%
Very Important (5)	50%	51%	49%
DK/NR*	4%	3%	4%
Total	**100%**	**100%**	**100%**
Not important (1 or 2)	3%	3%	2%
Important (4 or 5)	82%	82%	82%
Mean	***4.3***	***4.3***	***4.3***

Totals may not sum due to rounding
** excluded from calculation of mean importance*

Exhibit D10: Importance of Attributes that Influenced Choice of Home Heating System Indoor Air Quality

	Total	Participants	Non-Participants
Base (n)	*200*	*100*	*100*
Not at all Important (1)	1%	2%	-
(2)	2%	1%	2%
(3)	15%	17%	12%
(4)	33%	29%	36%
Very Important (5)	42%	38%	45%
DK/NR*	9%	13%	5%
Total	**100%**	**100%**	**100%**
Not important (1 or 2)	3%	3%	2%
Important (4 or 5)	74%	67%	81%
Mean	***4.2***	***4.1***	***4.3***

Totals may not sum due to rounding
** excluded from calculation of mean importance*

Exhibit D11: Importance of Attributes that Influenced Choice of Home Heating System Energy Efficiency

	Total	Participants	Non-Participants
Base (n)	*200*	*100*	*100*
Not at all Important (1)	1%	-	1%
(2)	1%	-	1%
(3)	9%	6%	12%
(4)	31%	29%	32%
Very Important (5)	50%	56%	43%
DK/NR*	10%	9%	11%
Total	**100%**	**100%**	**100%**
Not important (1 or 2)	1%	0%	2%
Important (4 or 5)	80%	85%	75%
Mean	***4.4***	***4.5***	***4.3***

Totals may not sum due to rounding
** excluded from calculation of mean importance*

Exhibit D12: Importance of Attributes that Influenced Choice of Home Heating System Initial Cost of the System

	Total	Participants	Non-Participants
Base (n)	*200*	*100*	*100*
Not at all Important (1)	2%	3%	1%
(2)	4%	3%	5%
(3)	20%	22%	17%
(4)	36%	40%	31%
Very Important (5)	30%	23%	36%
DK/NR*	10%	9%	10%
Total	**100%**	**100%**	**100%**
Not important (1 or 2)	6%	6%	6%
Important (4 or 5)	65%	63%	67%
Mean	***4.0***	***3.8***	***4.1***

Totals may not sum due to rounding
** excluded from calculation of mean importance*

Exhibit D13: Importance of Attributes that Influenced Choice of Home Heating System Operating Cost of the System (i.e., Fuel Cost)

	Total	Participants	Non-Participants
Base (n)	*200*	*100*	*100*
Not at all Important (1)	1%	2%	-
(2)	3%	2%	4%
(3)	15%	17%	12%
(4)	28%	23%	33%
Very Important (5)	40%	41%	38%
DK/NR*	14%	15%	13%
Total	**100%**	**100%**	**100%**
Not important (1 or 2)	4%	4%	4%
Important (4 or 5)	68%	64%	71%
Mean	***4.2***	***4.2***	***4.2***

Totals may not sum due to rounding
** excluded from calculation of mean importance*

Exhibit D14: Importance of Attributes that Influenced Choice of Home Heating System Both Initial Cost and Operating Costs

	Total	Participants	Non-Participants
Base (n)	*200*	*100*	*100*
Not at all Important (1)	1%	1%	-
(2)	5%	5%	4%
(3)	17%	17%	17%
(4)	33%	35%	31%
Very Important (5)	33%	29%	37%
DK/NR*	12%	13%	11%
Total	**100%**	**100%**	**100%**
Not important (1 or 2)	5%	6%	4%
Important (4 or 5)	66%	64%	68%
Mean	***4.1***	***4.0***	***4.1***

Totals may not sum due to rounding
** excluded from calculation of mean importance*

Exhibit D15: Trade Ally Satisfaction with Various Aspects of the Terasen Rebate Program

	Information on the Rebate	**Types or Numbers of Furnaces Eligible for Rebate**	**Application Procedures to Obtain the Rebate**	**Amount of the Rebate**
Base (n)	*200*	*100*	*100*	*40*
Not at all Satisfied (1)	10%	2%	4%	10%
Not Very Satisfied (2)	6%	4%	8%	8%
Somewhat Satisfied (3)	16%	16%	8%	22%
Very Satisfied (4)	32%	28%	24%	26%
Extremely Satisfied (5)	34%	46%	48%	30%
DK/NR*	2%	4%	8%	4%
Total	**100%**	**100%**	**100%**	**100%**
Not Very or Not at all Satisfied	16%	6%	12%	18%
Extremely or Very Satisfied	66%	74%	72%	56%
Mean	***3.8***	***4.2***	***4.1***	***3.6***

Totals may not sum due to rounding
** excluded from calculation of mean satisfaction*

Commercial Energy Assessments

Program Evaluation

Friuch Consulting

This report outlines and reports the outcome of work done between May and August, 2008 by Friuch Consulting for Terasen Gas, Demand Side Management and Marketing Department under the direction of Michelle Petrusevich.

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CONTENTS

EXECUTIVE SUMMARY

Friuch Consulting's services were retained in May, 2008 by Terasen Gas to complete an evaluation of the Commercial Energy Assessment Program between the periods of mid- 2005 and June, 2007. The program was created to help Terasen's commercial and small industrial customers identify inefficiencies in their energy consumption, and provide them with an action plan to reduce their natural gas consumption.

This program offers energy assessments at no cost to qualifying participants. Similar versions of this program have been offered to Terasen's commercial and small industrial customers since 2001. The current version of the program was launched in mid-2005 and provides free energy audits, conducted by third-party energy consultants to qualified program participants. The program is open to commercial and small industrial customers in the Lower Mainland, Squamish and BC Interior customers who spend more than $20,000 per year on natural gas.

There is a formal application process to qualify for the program but in practice, customers have liaised with their Account Manager who determines if an audit is warranted. Once an application is approved, a third-party energy efficiency consultant visits the customer's site and performs an evaluation. Site visits are typically completed within two hours and the third-party consultant produces a report summarizing the audit as well as any recommendations to increase energy efficiency.

Two third-party energy consultants carried out this work on behalf of Terasen Gas between mid-2005 and June, 2007. The primary consultants during this time period were Bill Hennessy and Peter Hill. Between them, they completed over 150 audits. Customers were to receive a written assessment and recommendations within two weeks of the visit and then a follow-up letter at a later date to verify what, if any, recommendations were implemented. Due to time constraints and staff limitations, this follow-up was done inconsistently amongst program participants during this period.

However, since July, 2007 Terasen has contracted this work Environ to provide a more "turnkey" service.

Note that this study was tasked with reviewing the effectiveness of the program prior to the date that Environ took the delivery of the commercial energy assessments.

The specified deliverables for this study are:

1. *Confirm the number of completed audits*
2. *Determine whether customers acted on recommendations provided in the energy audits*
3. *Estimate of energy savings (planned and achieved)*
4. *Determine top 2-5 recommended measures that were put forward by consultants and explain each in detail*
5. *Determine the percentage of measures that were implemented by the customers and estimate energy savings based on findings*
6. *Determine other factors that might have affected a customer's energy usage after recommendations were put forward*
7. *Provide feedback on overall effectiveness of program*

8. *Perform a free-rider analysis on the assessments,* i.e. what percentage of customers would have undertaken an energy audit in the absence of the free assessment program

9. *Provide recommendations on further improvements of the program*

10. *Determine other factors that might have affected a customer's energy usage after recommendations were put forward (increase or decrease in production/output, change of ownership, equipment upgrade, etc.)*

11. *Provide feedback on the overall effectives of the program*

All of the above deliverables were achieved and are covered in detail in the following sections. At a high-level, the findings are:

- **All of the audits conducted by Bill Hennessey and Peter Hill appear to have been successfully completed on 189 properties**

- **Research shows only 35% of customers audited actually implemented any of the recommended changes**

- **It is estimated that nearly 129,000 GJs of natural gas was saved as a direct result of Energy Assessments conducted during the study period as calculated by the sum of actual consumption decreases against expected usage for customers who implemented recommended changes**

- **The best recommended measures were ones that either had short return on investment for the customer and low up-front costs OR ones that replaced equipment at the end of its operational life-span with high efficiency boilers.**

- **The program was most effective with manufacturing customers in the rate classes that were eligible to apply for this program**

- **29% of respondents who did not make recommended changes also saw a decrease in their consumption after the audit – no attributable factor is known**

- **Overall, the program was effective in getting commercial customers to use less gas but the program was most cost-effective amongst customers in the manufacturing sectors which saw a nearly 300% return on investment**

- **The study determined that about 10% of program participants are "free riders" – defined as customers who would have paid for a Commercial Energy Assessment if it was not free.**

- **Detailed recommendations for improvements to the program are in the body of this report but at a high level: significantly reduce the number of free audits conducted for office buildings, apartments/strata corporations, hotels, restaurants and care homes and increase the intensity of the program for manufacturing sector customers**

<u>Note that data tables from this study were provided to Terasen in a digital format (Microsoft Excel) and will not be appended to this report.</u>

There are a number of benefits and dynamics to consider beyond what this study required that will be discussed in the body of this report. For example, the Commercial Energy Assessment Program has created a lot of good will for Terasen Gas that may have non-direct monetary gains for the company in this increasingly competitive market.

Terasen could also consider some lower-cost per customer demand side management activities in the future that would achieve results with a positive return on investment.

Friuch Consulting believes that Terasen Gas can improve upon the success of the Commercial Energy Assessment Program by screening the types of customers who receive free audits, offering new program options such as public workshops on demand-side management (DSM) and review some of the policies and procedures of the program overall.

Specific recommendations for improving the program include:

1. Spend more time nurturing and providing free Commercial Energy Assessments to manufacturing (light industrial) customers.

2. Do not conduct Commercial Energy Assessments with non-manufacturing customers unless there is a compelling reason to do so.

3. Develop public workshops aimed at non-manufacturing commercial customers that teach basic DSM techniques. Use these workshops to pre-qualify customers who are not manufacturers for free Commercial Energy Assessments.

4. Re-evaluate policies and procedures to ensure maximum follow-up with program participants.

5. Liaise with Environ and share the findings of this report with the auditors in hopes that it will improve the service they provide to Terasen's customers.

<u>The over-arching recommendation of this report is that the Commercial Energy Assessment Program be continued but modified to maximize its cost-effectiveness and reach.</u>

STATUS OF RESEARCH

Friuch Consulting's services were retained in May, 2008 by Terasen Gas to complete a program evaluation of the Commercial Energy Assessment Program between the periods of January, 2005 and June, 2007.This research took place as outlined below:

Table 1: Research Schedule

Research Design and Consultation with Terasen Gas	May, 2008
Customer Audits/Interviews	May-June, 2008
Analysis	July, 2008
Reporting	August, 2008

Note: An extension was requested and granted in mid-July when it became clear that additional analysis of the consumption data was required. Due date for final report moved to mid-September, 2008.

Field research was completed on June 26, 2008 and met the requirements as laid out in Terasen's RFP. The methodology for collecting the data was as follows:

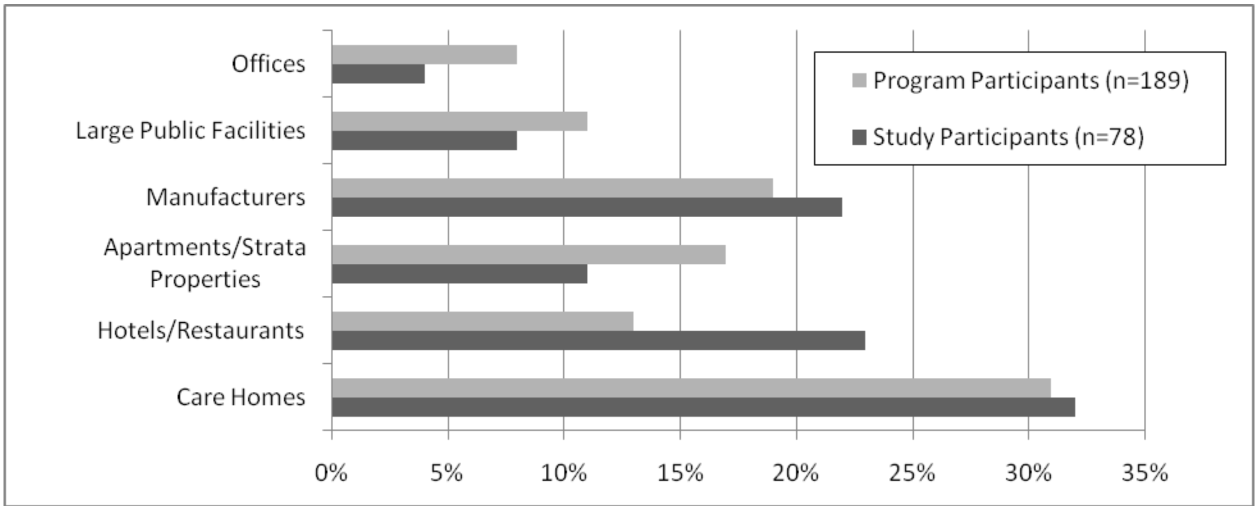
1. Aaron Cruikshank obtained copies of the audits conducted on all 189 properties prior to the start of field research.
2. Cristina Ambrosi (sub-contractor to Friuch Consulting) randomly called Commercial Energy Assessment Program participants that had audits between mid-2005 and June, 2007 to solicit their participation in a follow-up interview with Aaron Cruikshank of Friuch Consulting.
3. Aaron Cruikshank would request the historical billing records in advance of a telephone interview or face-to-face interview from Terasen Gas staff.
4. The interview followed a series of questions developed in conjunction with Terasen Demand Side Management and Marketing staff (see Appendix A).
5. Information from the interviews was entered into a spreadsheet for comparison and analysis with historical billing records.

Data collection from Terasen Gas to enable analysis of consumption data was completed on July 9, 2008. Interview analysis was completed on July 21, 2008. Consumption analysis was completed on August 13, 2008. Final findings of this report were validated by Bill Hennessey – the consultant that conducted the majority of the audits looked at by this study – in a phone interview.

In May, 2008, Terasen Gas provided contact information for 189 customer sites (some customers had multiple facilities that were reviewed with different accounts). Of these 189 customer sites, 50 customers representing 78 sites were audited/interviewed (hereafter: "interviewed") by Friuch Consulting. Thirty five interviews were conducted in the Metro Vancouver area – 15 of which were conducted face-to-face in accordance with the RFP guidelines. Fifteen interviews were conducted in the Interior – six of which were conducted face-to-face (Prince George and Quesnel).

Figure 1 (next page) shows that there was equal representation from Hotels/Restaurants and Manufacturers in this study but that Hotels/Restaurants may have been over-represented in the study compared to program participants. There was one customer with over 10 sites (Sandman Inn) that was interviewed by Aaron Cruikshank, effectively counting as one respondent towards the study quota but representing many more properties that each received an individual audit. Offices and Apartments/Strata properties may have been under-represented in this study compared to their program participation. In both of these cases, the researchers were dealing with property managers – many of whom did not want to participate in this study.

Figure 1: Study and Program Participation, by Type of Business



The low participation rate of property managers in this study representing Offices and Apartments/Strata Properties is attributed to the fact that it is unlikely that these managers were paid to respond to inquiries from Terasen Gas or contract researchers. It is thought that those property managers that did respond did so on their own time. Some property managers may have been able to claim the time they talked to Friuch Consulting against the customer in question. Operations managers and administrators/maintenance staff at Care Homes, Hotels, Manufacturers and Large Public Facilities would have, in most cases, been paid for any time they spent talking to Friuch Consulting.

Note that complete interview data has been submitted in an electronic format as an appendix to this report. It is not suitably formatted for print display but will be referenced throughout the report.

LIMITATIONS OF THIS STUDY

There are two primary limitations to this study:

1. There was no control group of customers. This means that any consumption reductions seen in program participants who did not make recommended changes cannot be attributed to the Commercial Energy Assessment Program.
2. The sample size is small and cannot yield statistically accurate findings. The findings from this report need to be interpreted as qualitative, not quantitative. Terasen was aware of the small sample size and accompanying limitations when the RFP for this project was issued.

A control group was not utilized by this study because it would have increased the cost of the study considerably and was not required by the original RFP. By not having a control group, the findings of this report (which deal exclusively with insights gained from analyzing customers who did make recommended changes to their gas-burning equipment) are still valid. What this study cannot address is what caused the gas consumption of some program participants who did not implement recommended changes to fall when they were expected to remain the same as they were before the audit.

This information, if obtained, would only add minor incremental insight to the entire study but would not likely alter the recommendations at the end of this report.

FINDINGS

This part of the report summarizes the findings as they match the deliverables specified in the RFP. Analysis of these findings and recommendations to improve on the Commercial Energy Assessment Program will follow in subsequent sections of this report.

AUDIT COMPLETION

During the process of sourcing interviewees for this project, none of the respondents indicated that they had not participated in the program. While not conclusive, it is a good indicator that all of the audits that were said to have been completed between January, 2005 and June, 2007 were completed.

There were some additional findings that question the quality of follow-up during program execution:

- 65% of customers interviewed for this study say that they did not hear from Terasen or their auditor following their original audit
- 22% of customers interviewed claim that they never received a copy of their audit after the site visit

This finding was validated in a phone interview with the principal auditor at the time – Bill Hennessey. Mr. Hennessey indicated that "follow-up [with customers] was a poorly executed before Environ took over delivery of this program".

It should be noted at this point that in many cases, the interviewee that talked to Friuch Consulting during field research was not the same person who participated in the original audit. It is feasible that a predecessor in many of these cases actually did receive the report and did not see fit to keep that report for their replacement. One could also assume that the interviewees were not aware of the study being conducted or the audit report was lost.

There is no indication that a lack of follow-up by Terasen led to the relatively low implementation rate amongst program participants. In fact, in the following sections, it will become clear that other factors had a bigger influence in the willingness of a customer to implement recommended changes to their gas infrastructure and usage.

IMPLEMENTATION OF RECOMMENDATIONS

As was mentioned in the Executive Summary, only 35% of the customers who participated in the Commercial Energy Assessment actually implemented any of the gas savings measures recommended by Bill Hennessey. This is not to suggest that a full 65% of program participants did not implement recommended changes. A full 9% of program participants were told in their assessments that there were no possible improvements to their current setup. This leaves only 56% of program participants that did not implement recommended changes.

Figure 2 (next page) shows what respondents cited as their reasons for not making recommended changes when asked. The majority (71%) of respondents who did not make recommended changes cited expense-related issues ("ROI too long" and "too expensive"). Return on Investment (ROI) concerns are closely related to sticker shock in that when someone cites length of ROI as an issue, it's typically because they need to borrow capital to invest and their concern is about how expensive that capital will be in terms of interest and the ability of that company to pay it off.

Figure 2: Respondents Who Did Not Make Recommended Changes, Reason for Not Making Changes (n=52)

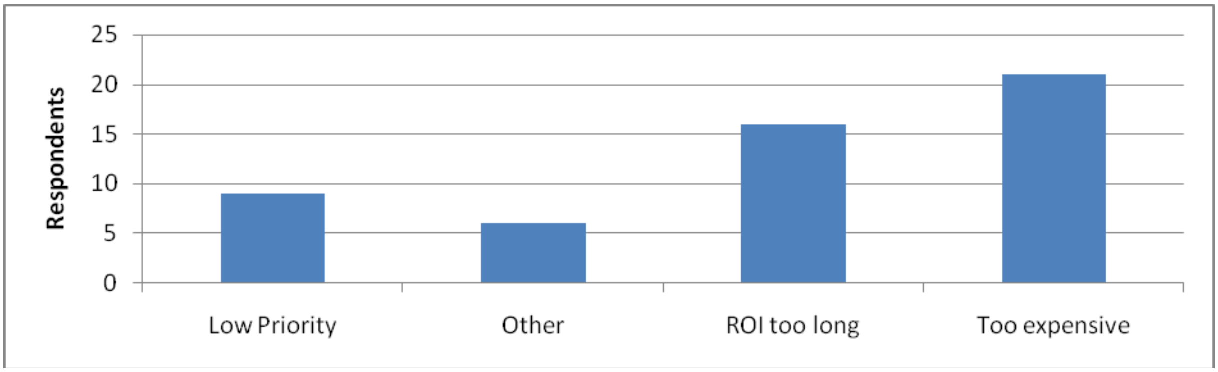
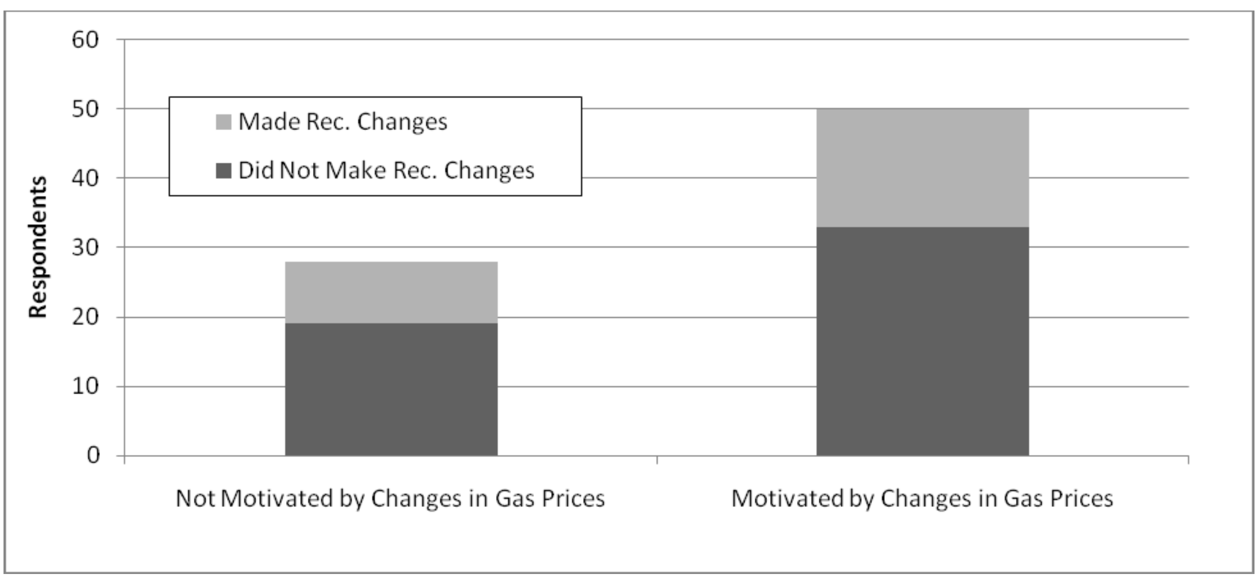


Figure 2 represents responses to question 6c from the customer questionnaire (see Appendix A).

When a recommendation was made to replace a boiler immediately or when the current boiler fails, respondents who did not make the recommended changes were twice as likely to cite expense or ROI issues rather than other reasons when asked why they did not make the changes. This finding was obtained by examining the reported reasons for not implementing recommended changes and comparing the un-coded reasons given.

Fluctuations in gas prices did not appear to have a major impact on a company's decision to implement recommended changes or not. Sixty-four percent of respondents indicated that they are motivated by fluctuations in natural gas prices. Figure 3 shows that those respondents who made recommended changes represent approximately one third of respondents motivated by changes in gas prices and one third of respondents not motivated by changes in gas prices. This validates the finding that the primary driver of the decision to make changes or not is most likely the sticker price of the recommended upgrades and, by extension, the ROI of the recommended changes. Figure 3 represents responses to questions 11 and 6 (see Appendix A).

Figure 3: Respondents, Sensitivity to Natural Gas Prices, by Respondents who Made Recommended Changes and Those Who Did Not (n=78)



Most economists familiar with heating fuel stocks such as natural gas agree that the biggest determinant of demand for gas is the weather, as measured by Heated Degree Days[1] (HDDs). Demand for gas is relatively inelastic to the market price at any given time (at least, at its current price point).

Figure 4 shows the graphical representation of the billing analysis for a customer who did make the recommended changes. Their audit was conducted in June, 2006. This customer only uses natural gas for radiant tube heaters that provide space heating for the production floor. Bill Hennessey recommended the installation of timers on the radiant tube heaters so that they didn't continue to heat the shop floor when operations were shut down for the night. Figure 4 clearly shows that this customer has subsequently reduced their consumption, most noticeably in response to the winter HDD spikes. Also note that their consumption has gone down while market prices for gas went down.

Figure 4: Billing Analysis, Great Little Box Company (Manufacturing Company)

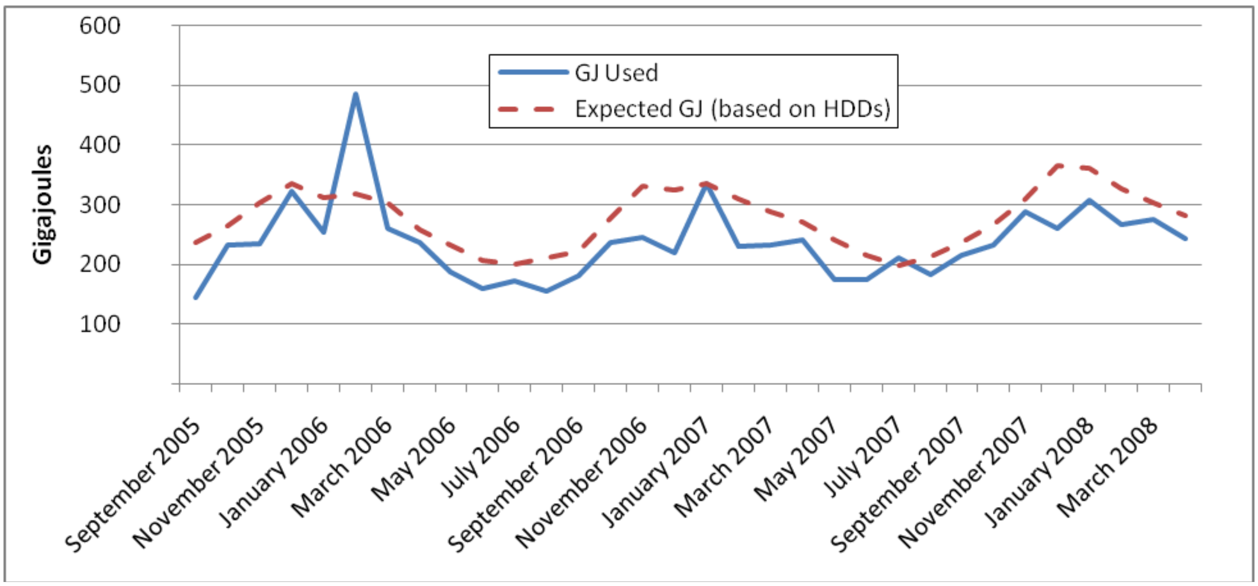


Figure 5 (next page) shows the graphical representation of the billing analysis for a customer who did not make the recommended changes. Their audit was conducted in February, 2006. Bill Hennessey recommended to this customer that they insulate the water pipes in the boiler room and install low-flow shower heads/faucet aerators throughout their facility. He estimated that they could save up to 25% of their hot water heating costs using these measures. Figure 4 shows that this customer's consumption is closely tied to HDDs with actual consumption (GJ used) exceeding expected consumption every winter heating season. They did not reduce their consumption following the audit.

[1] Source: Environment Canada

Figure 5: Billing Analysis, the Chateau (Care Home)

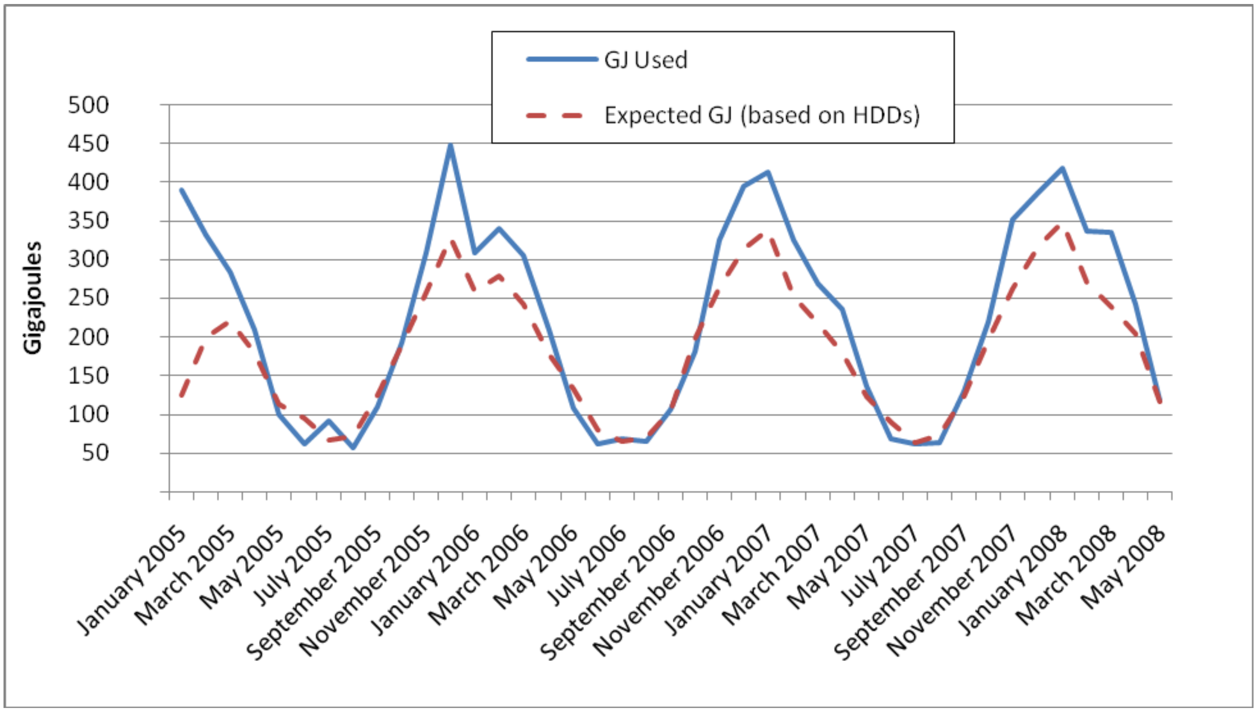


Table 2 shows the frequency that respondents made recommended changes by specific changes recommended. These recommendations have been coded for simpler analysis. Clearly cheaper, shorter-ROI options such as adjusting boiler/ heating, ventilating, and air conditioning (HVAC) settings or replacing old thermostats with new digital thermostats are the most popular options. Simple modifications to HVAC equipment (such as routing exhaust from one system to heat another room) were also popular. All of the top four recommended changes are potentially very short ROI solutions.

Please note that totals for the second column in Table 2 add up to more than the total sample size of 78. The consultants conducting the audits made more than one recommendation in most cases and respondents for this study were not restricted to one answer for question 6a – “Did your company implement any of the changes recommended in the audit” and “if yes, which changes were implemented?” (see Appendix A).

Table 2: Frequency of Recommended Change Implementation, by Type of Change Recommended (n=71)

Recommended Change	# of respondents this change rec. to	# of respondents who made change	Percentage
Replace Thermostats/Timers on HVAC systems	6	2	33%
Tweak boiler/HVAC settings	19	6	32%
Modify HVAC equipment	20	5	25%
Insulate water pipes in boiler room	20	4	20%
Replace boilers with high efficiency unit(s)	24	2	8%
Replace Makeup Air Units	12	1	8%
Install Low-flow shower heads/aerators on faucets	15	0	0%

ENERGY SAVINGS

This part of the analysis was the most complicated due to the high number of variables that had to be considered. To facilitate some type of analysis, Friuch Consulting obtained historical billing records showing GJs of Natural Gas used by each customer on a monthly basis during the study time period. While the quality of some of the historical consumption data was variable, it gave a relatively clear picture of consumption trends. GJs of gas used were compared with "expected" usage.

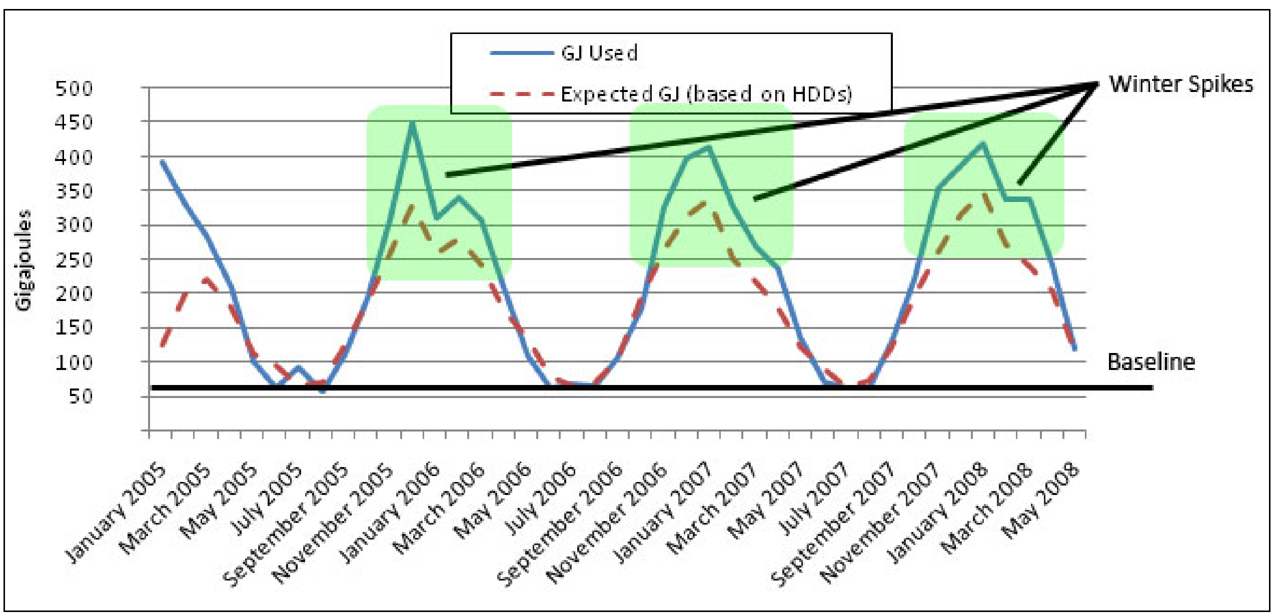
Put simply, here is how expected usage was calculated:

1. The researcher established a "baseline" of gas usage for each customer in the study. This baseline is the amount of gas that the company uses during months where they should not need to turn on the boiler for space heating. Space heating to compensate for outside temperature changes is the biggest cause of consumption variation from month to month.

   Figure 6 (below) illustrates how a baseline is established. In July of 2005, 2006 and 2007, both the GJs used and the expected GJs used bottom out at around 60 GJs for those months. This is what the customers' gas consumption looks like when they don't turn on their furnace for a month. All gas consumption that occurs above the baseline is attributed to consumption changes to address colder outside temperatures.

   In this specific example, the customer uses more than the expected amount of gas during the winter spikes. This is not uncommon since most customers are not using digital control systems which ramp up heating more incrementally than a person in control of a normal thermostat would. When it's very cold, many people turn the thermostat to a level that is much higher than is necessary to heat a room faster. The increased demand for gas places on the system by such behavior is illustrated in Figure 6.

Figure 6: Typical Billing Analysis Chart, Showing Baseline and Winter Spikes



2. Once the baseline was established, the amount of gas used during winter spikes was compared to the baseline. This gave a range of consumption that a business uses based on changes in outside temperature. After looking at the change between low and high heating seasons and comparing to HDDs for those seasons, a multiplier factor can be established to predict how much a customer will turn up the heat when

winter cold spikes hit. This information gives the researcher enough data to plot an "expected GJs used" line for each customer to compare against their actual consumption.

3. To compensate for production changes, the expected GJs line was multiplied by 1.n over time where "n" is the percentage increase or decrease in production.

4. The degree to which a customer's actual consumption is above or below the expected GJ use line is compared before and after the Terasen audit. If the customer's consumption rose against expected levels after the audit, it was assumed that the customer did not successfully reduce their natural gas consumption.

5. Customers who have lower consumption against expected levels after implementing recommended changes are counted as having successful outcomes for this program and the amount of GJs they saved below what was expected was counted towards the total GJs saved for this project. For customers who implemented recommended changes but saw an increase or no change in consumption were not counted in this study because their choice to consume more cannot be attributed to the Commercial Energy Assessment Program.

6. Once the analysis showed what customers in each of the different business types saved over what period of time, annual consumption reduction numbers for each category of business could be calculated. Table 3 (below) shows how the total GJs of gas consumption averted is calculated. For example, the research indicates that 12 out of the 59 program participants in this business type would actually decrease their consumption after implementing the recommended changes by Terasen.

   These 12 customers will reduce their consumption by an average of 473 GJs per year. Multiply program participants who are expected to have successful outcomes by the average annual gas savings for the category leading to a total annual gas consumption reduction by customers in this category of 5,676 GJs. Multiply this amount again by the average number of years since these customers had their audits to get the total amount of natural gas consumption averted by Terasen Gas during this study period.

Table 3: Commercial Energy Assessment Program Outcomes, by GJs of Natural Gas Consumption Averted (program participants who received audits between mid-2005 and June, 2007)

Type of Business	# of Program Participants	# that decreased consumption after implementing changes	Average Annual Gas Savings (GJ)[2]	Annual Gas Savings, program participants, this category (GJ)	Average Time (years) since audit	Total gas savings resulting from audits conducted mid-2005 to June, 2007 (GJ)
Care Homes	59	12	473	5,676	2.6	14,757
Manufacturers	**35**	**7**	**5,574**	**39,018**	**2.1**	**81,937**
Apartments/Stratas	33	11	591	6,501	2.7	17,552
Hotels/Restaurants	25	4	351	1,404	2.3	3,229
Large Public Facility	21	3	1,319	3,957	2.9	11,475
Offices	16	0	0	0	2	0
Totals	***189***	***37***		***56,556***		***128,950***

[2] Note that these amounts are averages and cannot be totalled.

By multiplying average consumption in a business type category by the estimated number of program participants who made the changes before seeing a drop in their consumption, by the number of years on average since this business type participated in the program – this study can arrive at a defensible number of GJs directly averted by the Commercial Energy Assessment program. This number appears to be roughly 129,000 GJs since these audits were conducted (see Table 3 on the previous page for details).

Put another way, program participants who implement the recommended changes are saving an average of 1,500 GJ per year. This is a substantial reduction and one that will continue to provide return on investment for Terasen for years to come.

SUCCESS OF RECOMMENDED MEASURES

The section above on Implementation touches on the issue of implementation rates of certain measures but does not discuss how effective each of these measures was in terms of reducing consumption. This analysis is difficult because in some cases, respondents made more than one of the recommended changes and could not attribute specific decreases in consumption to those changes. Because only a small percentage of respondents in this study implemented each recommended change, quantitative analysis is impossible.

Table 4: Relative effectiveness of recommended measures (n=28)

Recommended Change	% of respondents who implemented this change	Effectiveness
Replace Thermostats/Timers on HVAC systems	**33%**	This measure has a large impact in applications where there is a large area requiring space heating but not always in use. Best example is a manufacturing company that installed timers on their radiant tube heaters and saved 10,000 GJ over the past 17 months. For larger, open spaces with a low number of controls needed, this is a very low-cost upgrade.
Tweak boiler/HVAC settings	**32%**	Several of the respondents who implemented small changes to the settings of their boilers or HVAC equipment experienced immediate savings in their gas consumption for very little capital outlay.
Modify HVAC equipment	**25%**	In some cases, a simple modification of the boiler or process heat made a big difference in consumption. For example, one company used heat exhaust from a gas-fired process oven to heat another part of the shop instead of increasing boiler load.
Insulate water pipes in boiler room	**20%**	This measure is hard to isolate from other changes. Very few customers implemented this change alone. One of the customers that did implement this change in isolation from other changes saw a very modest 900 GJ of gas saved over the past two and a half years. The cost of insulating the pipes can be high if professional HVAC contractors are used.
Replace boilers with high efficiency unit(s)	**8%**	Most respondents who made this change saved about 1,000 GJ per year. This recommended change was not implemented often with most respondents citing cost as the number one issue. The ROI on a full boiler replacement is often 8-10 years.
Replace Makeup Air Units	**8%**	Several respondents made this recommended change and are saving, on average, 600 GJ per year. The ROI for these units can be fairly long so, like new boilers, few respondents made these changes.
Install Low-flow shower heads/aerators on faucets	**0%**	This measure was recommended to a fair number of respondents (15) but not implemented by any of them. In all cases, the recommendations were made to apartment buildings, care homes or hotels. It's possible that this is not a popular option because the cost of upgrading all taps and shower heads is relatively high (once parts and labour are factored in across 100+ units).

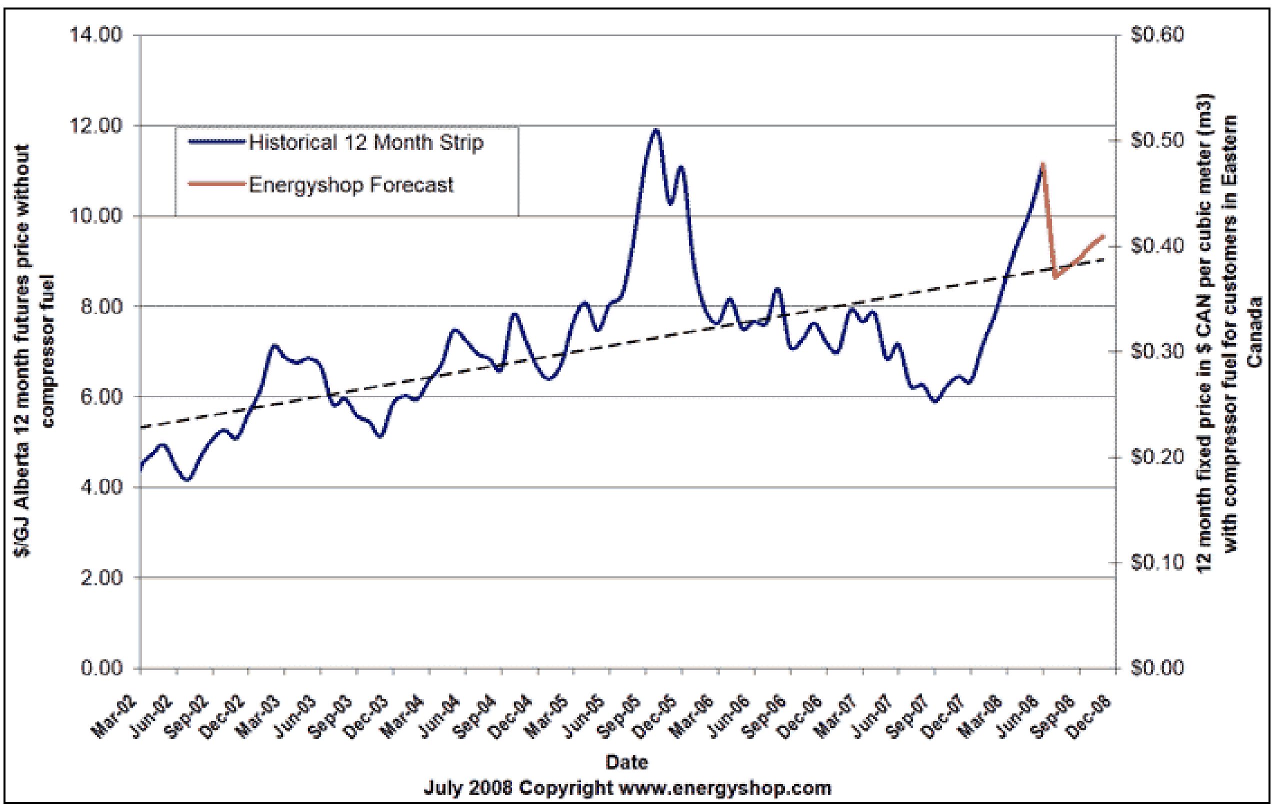
Table 4 (above) details the relative effectiveness of the recommended measures. Again, quantitative comparison is not possible due to the low sample size (28). There is a pattern in their uptake and relative effectiveness. New thermostats/timers, tweaking boiler/HVAC settings and modifications to HVAC equipment are the low-hanging fruit. These relatively cost-effective measures produce very short ROI for the customers and require small up-front capital expenditures. Replacing boilers, makeup air units and a large number of faucets/shower heads can be very costly with longer ROI.

Overall, 42% of respondents did not feel that the recommendations given to them were "reasonable". Respondents who did not feel the recommendations were reasonable were half as likely as respondents who liked the recommendations to actually implement the recommended changes.

OTHER FACTORS CONTRIBUTING TO CONSUMPTION DECREASES

Figure 7 (below) shows the historical market price of natural gas (per GJ) between March 2002 and December 2008 (estimated). Even though two-thirds of respondents claim to be motivated by changing prices in natural gas, those respondents who are price-sensitive and made changes to their consumption have done so during a period in which gas prices have dropped from a peak in the Q3 2005. This is a strong indicator that despite their claims of price-sensitivity (see question 11, Appendix A), there are other factors motivating their behavior – effectively ruling out price-sensitivity as a factor.

Figure 7: Market Price for Natural Gas ($CAD), March 2002 - December 2008 (estimated)



Twenty nine per cent of program participants who did not implement gas-saving measures suggested by Terasen Gas consultants still reduced their consumption after their audit. This number is calculated after factoring in staffing changes, changes in hours of operation or production increases and decreases at the customers' location.

Since consumers claim to be price sensitive when it comes to natural gas but their consumption behavior does not match fluctuations in the market price of gas, it is possible to rule out "real" price-sensitivity to market prices in gas and changes in the customers' operations. One possible factor that has caused this consumption decrease in program participants who did not make the recommended changes is that their very participation in the program is an indicator of a pre-existing interest in reducing consumption. The motivations for reducing consumption will vary – some program participants will be looking at opportunities to reduce consumption from an environmental standpoint while others will be looking for effective ways to reduce their operating expenditures. In any case, it is possible that there is a self-selection bias present amongst program participants which has led to this unexplained skew in the findings.

OVERALL EFFECTIVENESS OF THE PROGRAM

There are two measures of effectiveness to consider for this study:

1. Did the program get customers to reduce their consumption?
2. Was the program cost-effective?

It is clear from previous sections in this report that a significant number of program participants did reduce their natural gas consumption as a direct result of this program. Research shows that 57% of program participants who implemented the recommended changes saw a distinct decrease in their natural gas consumption not attributable to other factors.

However, this effectiveness was not spread evenly amongst the different business sectors represented by this study.

For the sake of discussion, let's look at the program cost from a pure consulting fees perspective. In discussions with Terasen Gas and its contractors, a number of different costs per audit were discussed – all of them in the neighborhood of $1,200. For the purposes of this part of the report, the cost per audit is assumed to be $1,200. The cost of a GJ of natural gas not saved is assumed to be the transportation fee for this rate class – approximately $2/GJ.

Table 5 shows that while 71% of Care Homes that implemented changes saw decreases, there were also 29% that saw increases in their consumption. Moreover, these businesses returned very modest average annual gas savings.

Table 5: Effectiveness of Program, by Participants who Implemented Recommended Changes and by Type of Business

Type of Business	# of Program Participants	# in study	% that implemented changes	Consumption post-implementation	Average[3] Annual Gas Savings (GJ)
Care Homes	59	25	28%	71% decreased, 29% increased	473
Manufacturers	35	17	35%	60% decreased, 40% no change	**5574**
Apartments/Strata Properties	33	9	56%	60% decreased, 20% no change, 20% increased	591
Hotels/Restaurants	25	18	28%	60% decreased, 40% no change	351
Large Public Facility	21	6	50%	33% decreased, 66% increased	1319
Offices	16	3	0%	*Insufficient data*	
Total	**189**	**78**			

[3] Average savings were taken by dividing the sum of total consumption reductions by the number of program participants in that company category.

Table 5 shows familiar figures but compares the types of business and whether or not they implemented the changes recommended by Terasen Gas and its consultants. The percentage of customers that implemented changes is taken straight from the interview data. The column showing "consumption post-implementation" is showing the outcomes of historical billing analysis and "Average Annual Gas Savings" looks at 12-month rolling average consumption for customers in these different business type categories and averages the savings achieved.

Manufacturing customers, as shown in Table 5, saw 60% of respondents who implemented recommended changes decrease their consumption while the rest saw no change. The biggest metric of effectiveness is how much natural gas these businesses saved, on average – over 3300 GJs per year. This is ten times that of nearly every other category of business in this study.

From this perspective, it is obvious that the program is more effective for some types of businesses than others. This dovetails into a discussion about the cost-effectiveness of the program.

For the sake of analysis, we'll calculate the cost-effectiveness of the program based on its cost vs. GJs of gas consumption averted. Based on 189 completed audits during the study period, the total cost of the audits was roughly $227,000. Table 6 shows that while the Commercial Energy Assessment managed a very modest 14% return on investment, the majority of that load was carried by businesses in the manufacturing sector.

Table 6: Cost-effectiveness of Commercial Assessment Program, by Business Type

Type of Business	# of Program Participants	# that decreased consumption after implementing changes	Average Annual Gas Savings (GJ)[4]	Average Time (years) since audit	Total Value of Gas Savings over average time since audit ($2/GJ)	Cost of Audits ($1,200 per)	ROI
Care Homes	59	12	473	2.6	$29,515	$70,800	(58%)
Manufacturers	**35**	**7**	**5574**	**2.1**	**$163,875**	**$42,000**	**290%**
Apartments/Strata Properties	33	11	591	2.7	$35,105	$39,600	(11%)
Hotels/Restaurants	25	4	351	2.3	$6,458	$30,000	(78%)
Large Public Facility	21	3	1319	2.9	$22,950	$25,200	(9%)
Offices	16	0	0	2	$0	$19,200	(100%)
Totals	***189***	***37***			***$257,903***	***$226,800***	

Table 6 further validates the findings that the most success in this program was found amongst program participants with manufacturing businesses. The sample size for offices was very low. While it appears that from cost-effectiveness perspective, this sector was a total loss, it's possible that if all 16 program participants were examined, at least a few would have seen decreased consumption. Hotels, restaurants and care homes saw dismal returns on investment.

The metric $2/GJ was used in the analysis for Table 6 because it is the easiest way to calculate the value of gas consumption averted (avoided cost). $2 is approximately how much Terasen charges for the transportation fees to Commercial/Light Industrial customers and represents a cost-recovery.

Overall, the Commercial Energy Assessment was moderately successful (keeping in mind that those businesses who implemented changes will continue to have lower-than-expected gas consumption for the foreseeable future) but if taken alone, the manufacturing customers that participated in this program carried the weight of the program. If they were not involved, the program would have suffered from significant negative returns on investment.

[4] Note that these amounts are averages based on the GJs saved, based on billing analysis undertaken on customers who participated in this study.

FREE RIDERS

One measure of the cost effectiveness of a program is a "free rider" analysis looking at program participants who accepted the audit service from Terasen at no cost to them when they would willingly pay for the service if it were not free. Note that as with all other methods of evaluating free ridership, the validity of this cost-benefit test is highly debatable. In this case, energy savings can be calculated from billing analysis alone.

In the case of the Commercial Energy Assessment Program, accurate free rider analysis is clouded by Terasen's business practice of offering free audits partly as a customer satisfaction tool. It is likely that the majority of customers in this study likely participated in the program because Terasen Gas and its sub-contractors pushed this free program on them. The option to pay for the audits was not made available to customers. The method by which customers found out about the program and agreed to participate is validated in responses to question 3 of the interview guide (see Appendix A). The majority of respondents found out about the program from their Account Manager or one of the contract auditors delivering this program. Very few of the study respondents found out about the program through Terasen's website or bill inserts.

For these reasons, it is the belief of Friuch Consulting that any conclusions drawn from this free rider analysis are notional at best.

Table 7 shows the percentage of "free riders" in each business category. This number is derived by dividing the number of study respondents who conducted other assessments on their business that were not subsidized at all by the number of study participants in a specific business type contacted for this research. See questions 4 and 4a in Appendix A. For example, a customer who participated in the Commercial Energy Program might have also conducted a self-funded lean manufacturing assessment to reduce operating costs or increase operating efficiencies. In either case, the customer shows a willingness to invest resources in efficiency and productivity increases. That percentage of free riders is extrapolated into a total number of free riders by business type in the last column by multiplying the number of program participants (n=189) by the percentage of free riders for that category.

Table 7: Free Ridership, by Type of Business (n=189)

Type of Business	# of Program Participants	% free riders	# free riders (mid-2005 to June 2007, est.)
Care Homes	59	4%	2
Manufacturers	35	29%	10
Apartments/Strata Properties	33	0%	0
Hotels/Restaurants	25	6%	2
Large Public Facility	21	0%	0
Offices	16	33%	5
Totals	***189***	***10% (avg.)***	***19***

Table 7 shows that Manufacturing and Office Building Management companies, as sub-groups of Terasen's Commercial Energy Assessment Program participants, have the highest incidence of free riders. In the case of Offices, it is appears that 33% of program participants would have paid for a Commercial Energy Assessment if Terasen had not offered it for free. Overall, it appears that roughly 10% program participants are free riders in that these 19 program participants (out of 189) would have paid for the assessment if it was not free.

ANALYSIS

This section of the report goes into more depth where there are interesting or puzzling findings. Analysis is done in the context of Terasen Gas' operational realities – the Commercial Energy Assessment Program needs to achieve the outcomes it is designed to achieve and it needs to do so in a cost-effective manner.

THE DECISION TO IMPLEMENT RECOMMENDED CHANGES OR NOT

The decision to implement recommended changes all appears to come back to the up-front cost and expected return on investment timescale for the recommended changes. This is not unexpected. For companies with complex financial considerations, the decision to make a costly upgrade to HVAC equipment is simple. To explain why facilities like Provincially-funded Care Homes do not often implemented recommended changes, a more in-depth analysis of these facilities and their relationship to funders is warranted:

1. In many cases, the operations staff (including maintenance) is not led at the executive level by someone with operations subject matter expertise. For this reason, upgrades to heating systems are placed in competition with other, more noticeable areas for improvement around the property such as new beds, maintenance of furniture for tenants, etc… Little or no consideration is given to the fact that if money was saved in the energy department, more money would be available for what are usually cosmetic repairs to furniture and the building itself.

2. The funding for these Care Homes comes through the Ministry of Health and then through the department responsible for Care Homes before getting to the Care Home Executive Director who then assigns a budget to maintenance. This means that there are a number of steps and series of approvals that any major infrastructure upgrade would need to go through before it could get implemented. Capital expenditures would have a direct impact on operating costs, potentially putting management at the Care Home in violation of their arrangement with the Province.

In the case of most manufacturing companies where the owner of the company is also the major shareholder, it is easier to justify large capital expenditures as long as the net present value (NPV[5]) is high over the short-term for the company. Improvements to the facilities can also be a beneficial expense for the company at tax time. The levels of approvals that a new equipment requisition must go through at most manufacturing companies are much fewer than they are for a Provincially-funded Care Home. Small to medium-sized manufacturing companies in BC tend to also have very flat hierarchies where an Operations Manager could typically go straight to the CFO or CEO to get new HVAC equipment approved.

<u>In conclusion, it seems clear that manufacturing companies have the motivation and the ability to make the changes recommended by Terasen Gas through the Commercial Energy Assessment Program more easily than other types of businesses</u>. This conclusion was validated by Bill Hennessey in a phone interview.

[5] Net present value is the standard method for using the time value of money to appraise long-term projects. Used for capital budgeting, and widely throughout economics, it measures the excess or shortfall of cash flows, in present value terms, once financing charges are met.

ENERGY SAVINGS

The assumptions behind the calculations of energy savings are defendable but not perfect. There were a number of issues with the data quality both from Terasen Gas and from Environment Canada (regional HDD statistics). For example, some of the historic billing records for the customers in this study only covered billing intervals up to November, 2007. When looking at customers whose audits were conducted in mid-2007, this did not provide sufficient post-audit data for an accurate analysis. In other cases, the billing records do not go much further past the audit while some records go back nearly 10 years.

On the Environment Canada front, HDD data for the Metro Vancouver area was available well beyond the study period for this program evaluation – ideally, this study was to review historical billing records two years before the audit took place. Outside of the Metro Vancouver area, monthly HDD summary statistics for regions like Quesnel and Kelowna are only available after January, 2005. For audits conducted in 2005 in these regions, the HDD data was not available to calculate expected consumption two years in advance of the audit.

Despite these challenges, every effort was made to compensate for data quality variability. The fact that customers who did not make the recommended changes and those who did were not compared with a control group of customers who did not participate in the program means that the calculation of total energy savings could only look at companies who made the recommended changes.

It is the belief of Friuch Consulting that customers who did not make the recommended changes were influenced by the audit process and while they might not have made significant equipment upgrades, may well have changed their operational practices following the audit. This would account for the customers who participated in the program, chose not to make the recommended changes but saw a significant drop in gas consumption following audit.

<u>In conclusion, it is clear that the program led to gas savings for customers who did implement the recommended changes.</u>

SUCCESS OF RECOMMENDED MEASURES

This is a relatively simple analysis. It is clear from the findings that low-cost, short ROI solutions are favoured over high-cost, long ROI options. This finding was not unexpected. Any customer doing a net present value (NPV) analysis (consciously or sub-consciously) will steer away from options that have an ROI of three years or longer. Long ROI options typically lead decision-makers to investment opportunities over infrastructure upgrades.

Setting popularity aside for a moment, it's also clear that these low-cost, short-ROI measures have had big impacts in the energy consumption of the companies that chose to implement them. One customer – a manufacturing customer – managed to save over 10,000 GJ of gas in the last 17 months by putting timers on their radiant tube heaters so that they don't run when the production floor is closed for the night. Replacing a boiler with a higher efficiency unit only appears to save most customers 1,000 GJ per year.

It is doubtful that most customers that participated in this program after receiving their audits took the time to calculate the actual NPV for the proposed solutions. It's more likely that the decision makers have an intuitive feel for NPV or simply relied on the ROI estimates provided in many of the audits and made their decision based on current cash-flow issues.

The 42% of participants who felt that the recommendations given were "not reasonable" are likely disappointed that the energy assessment did not take into consideration basic economic principles for small- to medium-sized businesses where a new boiler is not a viable option.

In conclusion, it appears that most customers who participated in the Commercial Energy Assessment Program gravitate towards low-cost, short-ROI solutions because they have more important short-term priorities for spending within their company. They clearly also expect Terasen to understand this dynamic when coming in to audit their business.

OVERALL EFFECTIVENESS OF THE PROGRAM

Clearly, this program was most effective amongst manufacturing companies – not just because of their modest uptake rate but because of the high ROI this group provides for Terasen Gas in the maintenance of this program. Upon reviewing program costing and ROI from these customer groups in Table 6, it is clear that manufacturing customers are largely responsible for the program making a 14% ROI overall.

In conclusion, these findings clearly indicate that the program was most effective amongst manufacturing clients; therefore, from a cost-effectiveness perspective, it was only cost-effective to deliver the program to this group. All of the other businesses types had negative ROI at the end of the study.

However, there are some public relations "optics" reasons why it would be a good idea to continue to offer free Commercial Energy Assessments to Large Public Facilities like malls, sports arenas and colleges – these high-profile facilities often have ties to government agencies and providing good services to these companies creates good will in the community that can be "cashed in" during regulatory filings or normal rate increases. Moreover, these companies use large volumes of gas and even if they cannot effectively reduce their consumption, it is in Terasen's best interest to keep them as a customer long-term.

CONCLUSIONS

The conclusions of this study are straightforward:

- **All of the audits conducted by Bill Hennessey and Peter Hill appear to have been successfully completed on 189 properties**
- **Only 35% of customers audited actually implemented any of the recommended changes**
- **It is estimated that nearly 129,000 GJ of natural gas was saved as a direct result of Energy Assessments conducted during the study period as calculated by the sum of actual consumption decreases against expected usage for customers who implemented recommended changes**
- **The best recommended measures were ones that either had short return on investment for the customer and low up-front costs OR ones that replaced equipment at the end of its operational life-span with high efficiency boilers.**
- **The program was most effective with manufacturing customers in the rate classes that were eligible to apply for this program**
- **29% of respondents who did not make recommended changes also saw a decrease in their consumption after the audit – no attributable factor is known**
- **Overall, the program was effective in getting commercial customers to use less gas but the program was most cost-effective amongst customers in the manufacturing sectors which saw a nearly 300% return on investment**
- **Roughly 10% of program participants are "free riders"**

This leads to the overall conclusion that the program has been a success to date but that it needs to focus on customer segments with the highest ROI for Terasen (manufacturing companies) and customers where there is a public relations reason for offering free energy assessments despite low ROI for Terasen. Terasen could offer a different slate of demand side management programs for customer segments that have low ROI for Terasen (apartments, care homes, hotels, restaurants and offices).

Specific recommendations for changes to the program are covered in the next section.

RECOMMENDATIONS

The conclusions from this study indicate that a diversified portfolio of demand-side management programs available to commercial and light industrial customers is warranted. The big picture implication of this reality is that some customers should receive more one-on-one attention from Terasen while groups with lower successful outcome rates should receive more general information (and more cost-effective communications) about demand-side management.

This is not suggest that non-manufacturing customers would no longer receive audits under any circumstances – just that they would need to be pre-qualified before participating to ensure that they are the type of customers that is more likely to invest in infrastructure upgrades to reduce gas consumption.

The recommended improvements to the Commercial Energy Assessment Program are as follows:

1. **Spend more time nurturing and providing free Commercial Energy Assessments to manufacturing customers.**
    a. Ensure the follow-up is done with each of these customers because that may have an impact on their willingness to make recommended changes to their HVAC systems.
    b. Consider providing more in-depth assessments for these customers including some advice on sourcing the recommended infrastructure upgrades.
    c. Be pro-active in seeking out these customers.
2. **Do not conduct Commercial Energy Assessments with non-manufacturing customers unless:**
    a. The customer has been through a series of free public workshops on demand side management measures and understands what these measures cost, the potential benefit to the company and if they have the ability to make these changes at this time.
    b. There is a public relations reason to do so.
3. **For low-ROI customers, develop public workshops that teach basic consumption reduction techniques.**
    a. Be sure to target the decision-makers in each sector… not necessarily the operations/maintenance manager.
    b. Workshops are a lower-cost way of pre-screening companies that are committed to making operational changes to reduce natural gas consumption.
4. **Account managers and the consultants conducting the audits clearly need to have some kind of Customer Relationship Management (CRM) solution in place** so that everyone who touches these customers from Terasen knows when each customer was last contacted and knows the context of that contact.
5. **Communicate with Environ and the auditors currently delivering the Commercial Energy Assessment Program and ensure that they pay special attention to low-cost, short-ROI solutions more often than costly upgrades such as boiler replacements.**

The following page details two specific DSM Program delivery vehicles that Terasen could consider developing to improve the overall effectiveness of the program. The expected outcomes of implementing these recommendations are:

1. **Vastly improved cost-effectiveness of program**
2. **Bigger reach into the customer base with less effort**
3. **A more streamlined process of tracking customers who leverage this program.**

IN-DEPTH COMMERCIAL ENERGY ASSESSMENTS FOR MANUFACTURING CUSTOMERS

The findings of this study show that the Commercial Energy Assessment Program (as delivered between mid-2005 and June, 2007) was most effective amongst customers in the manufacturing (light industrial) sector. The recommendation from Friuch Consulting is to "spend more time nurturing and providing free Commercial Energy Assessments to manufacturing customers." While acknowledging that the program has been successful with this sector, it is also important to remember that only 35% of program participants in this sector actually implemented the recommended changes. While that 35% of program participants generated some significant energy savings, even more savings could be achieved by this program if more customers in this sector had successful outcomes in reducing gas consumption.

Any changes to the Commercial Energy Assessment Program for this sector should focus on how to reach the 65% if program participants that did not make recommended changes can be encouraged to do so. For most of the respondents in this study in the manufacturing business that did not make recommended changes, they cited ROI issues. In these cases, equipment upgrade subsidies should be considered in cases where there is a great opportunity for gas savings.

In other cases, manufacturing customers might simply require more in-depth information such as specific equipment specs, suppliers and recommended installers. Other customers in this sector might be willing to ignore long ROI if there was a publicity/marketing benefit to going "green" with their HVAC systems. For example, one customer in the Apartment sector claimed to have initiated a pilot project on-site with Terasen Gas and IBC Boilers.

This category of customer is worth spending additional time and resources on because the return on investment for Terasen is so high.

SECTOR-SPECIFIC WORKSHOPS

For those customers who are least likely to implement recommended changes from the Commercial Energy Assessment Program, public workshops might be the best solution. These workshops would target specific customer groups such as apartment building managers, care home operations managers and property managers. In a telephone interview with Bill Hennessey – who was a Commercial Energy Assessment Program auditor and is currently an auditor through Environ – Bill validated Friuch Consulting's assessment of groups who have a low implementation rate as well as the recommendation to offer public workshops to these groups.

Bill Hennessey also indicated that he would be well positioning to provide the content for these workshops as he has already established "normal" gas consumption profiles for these customers based on his audit experience. Similarly, he has seen the most common areas for improvement in specific properties. This kind of information, paired with more general DSM information could provide the foundation for a successful public workshop.

The cost of one workshop would exceed the cost of a single audit but could reach dozens of customers in that sector. For the same expenditure, a public workshop campaign could expand the reach of the Demand Side Management program. There is support for this recommendation amongst the study respondents – 81% of respondents said that they would be interested in "educational seminars to learn more ways to reduce gas consumption" (see question 7b in Appendix A).

The content of these workshops should focus on informing customers what a normal gas consumption profile looks like, the many reasons why a customer's gas consumption might be above average and a number of pointers on how to reduce consumption. Customers that are very keen to do everything they can to reduce their consumption could apply for a Commercial Energy Assessment of their own. For most customers, this would not be necessary.

APPENDIX A: INTERVIEW SCRIPT

Interviewee:____ **Date:** _________________

Terasen Gas Commercial Energy Assessment Review – Customer Interview Script v.3 (Final)

Terasen Gas, as a Provincially regulated utility company, must ensure that expenditures for energy efficiency related programs are done prudently such that Terasen Gas can defend the programs to the regulator as well as the customer and the shareholder. Terasen Gas has not completed a comprehensive review of the Commercial Energy Assessment program in recent years and as such has hired Friuch Consulting to review the effectiveness of the program.

1. What is the nature of your business?

2. What does your company use natural gas for?
   a. Space heating?
   b. Vehicle Fuel?
   c. Water heating?
   d. Electricity co-generation?
   e. Manufacturing process?

3. How did you become aware of the Commercial Energy Assessment program? DO NOT READ, CHECK ALL THAT APPLY

   ☐ Insert in Terasen Gas Bill
   ☐ Direct mail from Terasen Gas
   ☐ Terasen Gas Website
   ☐ Through heating or furnace contractor
   ☐ Word of Mouth
   ☐ Account Manager
   ☐ Trade show or consumer event
   ☐ Other websites
   ☐ **Other (list)**

4. During the past five years, has your company conducted any assessments of other areas of the business with an eye to find ways to save money and/or increase return on investment? Eg. Waste reduction programs, electricity audits, lean production analysis?

   a. If yes, were these studies internally funded or did your company leverage government programs?

5. Did you receive a copy of your Energy Assessment after it was completed?
   a. <go over the audit with them to re-cap what was recommended>
   b. Were the recommendations reasonable?

6. Did your company implement any of the changes recommended in the audit?

   a. If yes, which changes were implemented and when?

   b. If yes, on a scale of one to five, where one is not at all important and five is very important, how important was the Terasen Gas free Energy Assessment in your decision to make these changes?
   ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ Don't know
   c. If no, why did your company decide not to make any of the recommended changes?

7. Was there any follow-up from Terasen Gas staff or the auditor since your Energy Assessment?

   a. If no, would you like someone from Terasen Gas to follow up with you?
   b. Would you be interested in educational seminars to learn more about ways to reduce your gas consumption? Online vs. Face to face?

8. <if changes were implemented> Did you do an analysis of your energy savings after you implemented recommended changes?

   a. If yes, were the results what you expected?
   b. If no, did you notice an overall decrease in your Terasen Gas bill?

9. Did your company's production increase/decrease after your energy assessment? Eg. Did you ramp up production? Did you expand your operation?

10. Did your company change owners since the energy assessment?

11. At any point before or after the energy assessment, did an increase in natural gas prices motivate your company to examine its natural gas consumption?

12. Have you done any major equipment upgrades since the energy assessment?

13. Did you make any structural changes to your facility since the energy assessment?

    a. Are you still in the same building as you were when the energy assessment was conducted?
    b. Have you increased the floor space of your company since the energy assessment was conducted?

14. How many employees does your company have at the moment?

    a. Has the number increased or decreased since the Energy Assessment?
    b. Have you changed your hours of operation since the Energy Assessment?

15. What was your overall satisfaction with the audit?

    a. Would you have liked any other information on the audit?

16. Additional comments about the Energy Assessment Program.

Commercial Energy Assessments

Program Evaluation

Friuch Consulting

This report outlines and reports the outcome of work done between January and March, 2010 by Friuch Consulting for Terasen Gas, Demand Side Management and Marketing Department under the direction of Michelle Petrusevich and Ramsay Cook. **Note that Friuch Consulting is now known as Ignitia Consulting as of March, 2010.**

Friuch Consulting

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EXECUTIVE SUMMARY

Friuch Consulting's services were retained in January, 2010 by Terasen Gas to complete a second evaluation of the Commercial Energy Assessment Program looking at program participants between the periods of July 2007 and July 2009. A previous review of the program was conducted in August, 2008 by Friuch looking at program participants between the periods of June 2005 and June 2007. The program was created to help Terasen's commercial and small industrial customers identify inefficiencies in their energy consumption, and provide them with an action plan to reduce their natural gas consumption.

This program offers energy assessments at no cost to qualifying participants. Similar versions of this program have been offered to Terasen's commercial and small industrial customers since 2001. The current version of the program was launched in mid-2005 and provides free energy audits, conducted by third-party energy consultants to qualified program participants. The program is open to commercial and small industrial customers in the Lower Mainland, Squamish and BC Interior customers who spend more than $20,000 per year on natural gas.

There is a formal application process to qualify for the program but in practice, customers have liaised with their Account Manager who determines if an audit is warranted. Once an application is approved, a third-party energy efficiency consultant visits the customer's site and performs an evaluation. Site visits are typically completed within two hours and the third-party consultant produces a report summarizing the audit as well as any recommendations to increase energy efficiency.

Third-party energy consultants carried out this work on behalf of Terasen Gas between July 2007 and July 2009 and completed 158 audits. Customers were to receive a written assessment and recommendations within two weeks of the visit and then a follow-up letter at a later date to verify what, if any, recommendations were implemented.

The specified deliverables for this study are:

1. Determine whether customers acted on recommendations provided in the energy audits
2. Estimate of energy savings (planned and achieved)
3. Determine the percentage of measures that were implemented by the customers and estimate energy savings based on findings
4. Determine other factors that might have affected a customer's energy usage after recommendations were put forward
5. Provide feedback on overall effectiveness of program
6. Perform a free-rider analysis on the assessments, i.e. what percentage of customers would have undertaken an energy audit in the absence of the free assessment program
7. Provide recommendations on further improvements of the program

All of the above deliverables were achieved and are covered in detail in the following sections. At a high-level, the findings are:

- It is estimated that 43% of program participants made some or all of the recommended changes.

- 52% of program participants saw a positive outcome (demonstrable reduction in gas consumption) whether they made the recommended changes or not.

- 13% of program participants made the recommended changes but saw no decrease in consumption. It is estimated that nearly 250,000 GJs of natural gas was saved as a direct result of Energy Assessments conducted during the study period.between July 2007 and November 2009.

- Manufacturing companies outperformed every other business type in terms of making recommended changes and seeing a substantial decrease in consumption. Offices, Apartments/Stratas and Hotels/Restaurants performed very poorly in terms of making the recommended changes and reducing their consumption.
- 24% of customer premises that did not make recommended changes also saw a decrease in their consumption after the audit. We are giving Terasen credit for 10% of this reduction as per a study by Sarah Darby[1] which proves demand-side management energy audits achieve modest reductions in consumption even when no major changes are made by introducing a "conservation culture" to the organization. These numbers are included in the total GJs saved above.
- Overall, the program was effective in getting commercial customers to use less gas but the program was most effective in the "manufacturing" sector which saw 92% of the total GJs reduced in this study while representing only 23% of the total program participant premises.The study has determined that roughly approximately 35% of program participants are "free riders" – defined as customers who would have paid for a Commercial Energy Assessment if it was not free. Statistics on how much these participants would be willing to pay are not available. Most participants determine the value of such programs in terms of how much ROI they can produce – not a flat fee for the service.

Note that data tables from this study were provided to Terasen in a digital format (Microsoft Excel) and will not be appended to this report.

Friuch Consulting believes that Terasen Gas can improve upon the success of the Commercial Energy Assessment Program by changing the program requirements for customers to receive free audits, offering new programs such as public workshops on demand-side management (DSM) and review some of the policies and procedures of the program overall.

Specific recommendations for improving the program include:

1. Move the minimum amount of gas purchased to participate in the program to $75,000 per year.

2. For customers spending less than $75,000 per year on gas, develop public workshops that teach basic consumption reduction techniques.

The over-arching recommendation of this report is that the Commercial Energy Assessment program be continued but significantly modified to maximize its cost-effectiveness and reach.

STATUS OF RESEARCH

[1] Darby, Sarah (2001) "Making it obvious: designing feedback into energy consumption". *Energy Efficiency in Household Appliances and Lighting* (30 January 2001), pp. 685-696.

Friuch Consulting's services were retained in January 2010 by Terasen Gas to complete a program evaluation of the Commercial Energy Assessment Program between the periods of July 2007 and July 2009.This research took place as outlined below:

Table 1: Research Schedule

Research Design and Consultation with Terasen Gas	January, 2010
Customer Audits/Interviews	January – February, 2010
Interim Report	Completed February 22, 2010
Analysis	March, 2010
Reporting	March-May, 2010

Field research was completed on February 9, 2010 and met the requirements laid out by Terasen at the beginning of the project. The research methodology for the study was as follows:

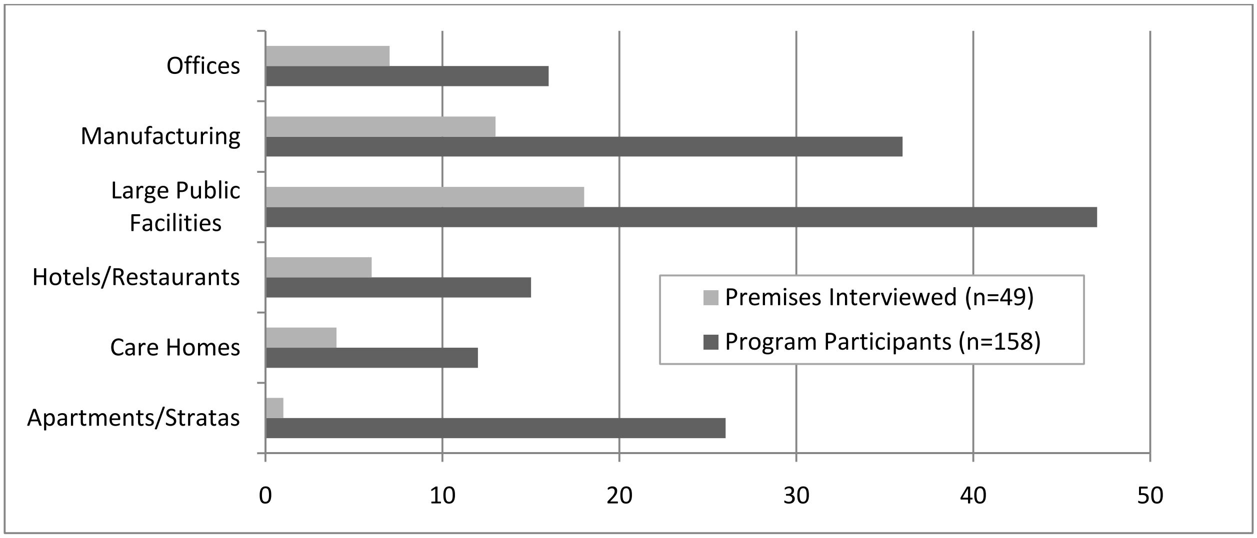
1. Aaron Cruikshank obtained copies of the audits and historical billing data for all 158 properties prior to the start of field research.
2. Min Soo Kim called program participants that had audits between July 2007 and July 2009 to solicit their participation in a follow-up interview with Aaron Cruikshank or Sean Peters of Friuch Consulting.
3. The interview followed a series of questions developed in conjunction with Terasen Demand Side Management and Marketing staff (see Appendix A).
4. Information from the interviews was entered into a spreadsheet for comparison and analysis with historical billing records.

Copies of all 158 assessments were provided to Friuch by Terasen on January 8, 2010. Friuch received very high quality historical billing data for all 158 program participants in our study period on February 1, 2010. Interviews were completed on February 9, 2010. Consumption Analysis was completed on February 22, 2010. Interim findings on overall program savings and return on investment were submitted to Terasen on February 23, 2010.

Of the 158 customer premises (some customers had multiple facilities or "premises" that were reviewed with different accounts), Friuch interviewed 30 program participants (respondents) representing 49 customer premises.

Figure 1 (next page) shows that there was reasonable representative samples of all business types except "other", and Apartments/Stratas. The response rate for Apartments/Stratas was very poor in terms of the interviews. The researcher scheduling the interviews was unable to find a sufficient number of property managers to speak with in this category. There were 26 apartment/strata customers in the study sample – all of whom were contact multiple times to complete this research.

Figure 1: Study and Program Participation, by Type of Business



Most of the respondents for the Apartments/Stratas category are professional property managers. Many of these property managers booked appointments to speak with Friuch staff, but on multiple occasions these appointments were left unattended by the property managers despite attempts to re-schedule interviews. The low participation rate of property managers in this study representing Apartments/Strata Properties is attributed to the fact that it is unlikely that responding to inquiries from Terasen would have been billable as per their contract with the building owners.

Those property managers that did respond likely did so on their own time. Operations managers and administrators/maintenance staff at Care Homes, Hotels, Manufacturers and Large Public Facilities would have, in most cases, been paid for any time they spent talking to Friuch Consulting.

<u>Note that complete interview data has been submitted in an electronic format as an appendix to this report. It is not suitably formatted for print display but will be referenced throughout the report.</u>

LIMITATIONS OF THIS STUDY

There is one primary limitation to this study:

1. The sample size is small and cannot yield statistically accurate findings. The findings from this report need to be interpreted as qualitative, not quantitative. Terasen was aware of the small sample size and accompanying limitations when the RFP for this project was issued.

METHODOLOGY FOR CALCULATING GJS SAVED

Most economists familiar with heating fuel stocks such as natural gas agree that the biggest determinant of demand for gas is the weather, as measured by Heated Degree Days[2] (HDDs). Demand for gas is relatively inelastic to the market price at any given time (at least, at its current price point).

Figure 2 shows the graphical representation of a typical billing analysis for a program participant who did make the recommended changes. This example audit is from the 2005-2007 program review and was conducted in June, 2006. This manufacturing company uses natural gas for radiant tube heaters that provide space heating for the production floor. The recommended change was to install timers on the radiant tube heaters so that they did not continue to heat the shop floor when operations were shut down for the night. Figure 2 clearly shows that this customer has subsequently reduced their consumption, most noticeably in response to the winter HDD spikes.

Figure 2: Billing Analysis, Manufacturing Company that Made Recommended Changes

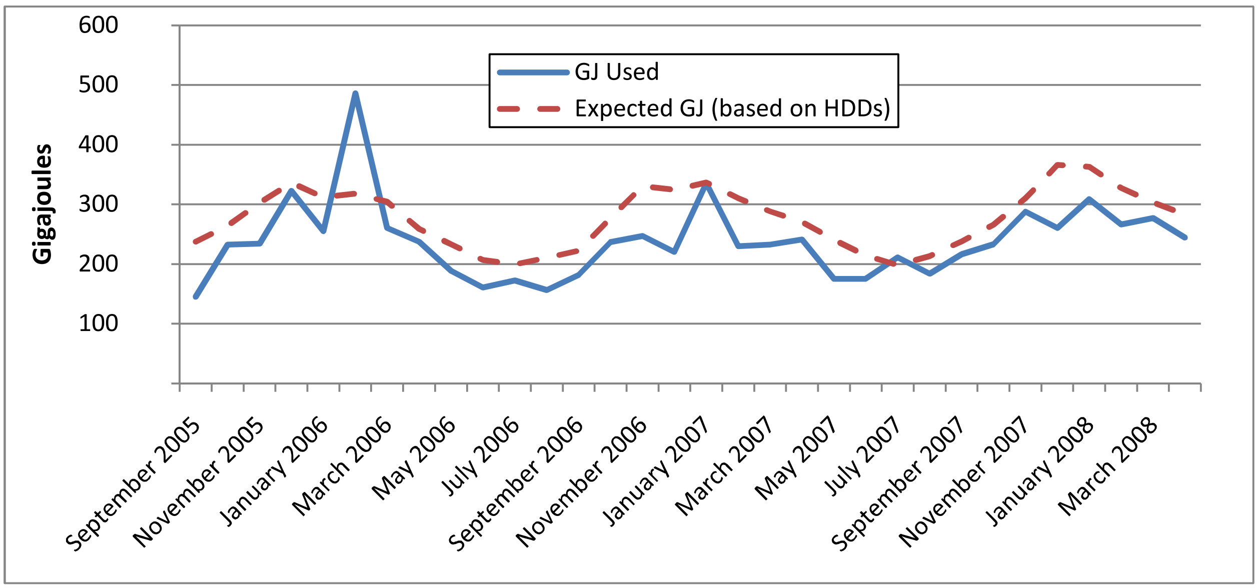
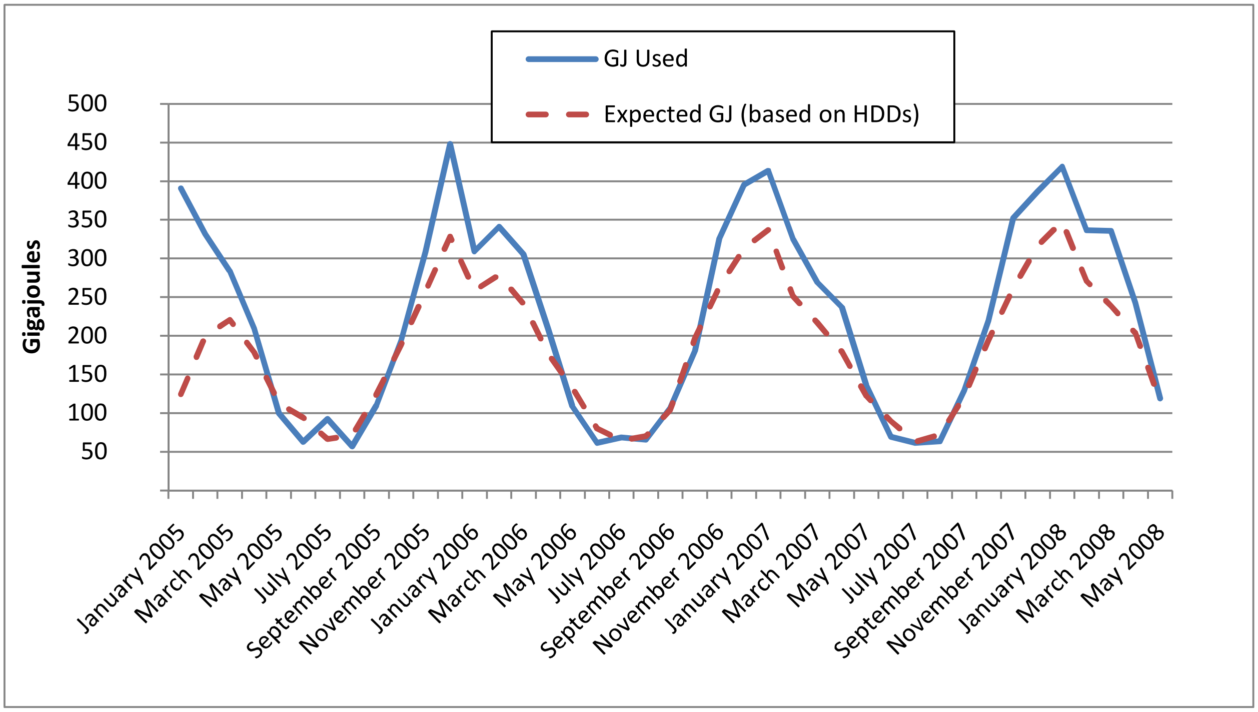


Figure 3 (next page) shows the graphical representation of a billing analysis for a Care Home customer from the 2005-2007 program review who did not make the recommended changes. Their audit was conducted in February, 2006. Figure 3 shows that this customer's consumption is closely tied to HDDs with actual consumption (GJ used) exceeding expected consumption every winter heating season. They did not reduce their consumption following the audit.

[2] Source: Environment Canada

Figure 3: Billing Analysis, Care Home, Did Not Make Recommended Changes



Calculation of these findings was complicated due to the high number of variables that had to be considered. To facilitate some type of analysis, Friuch obtained historical billing records showing GJs of Natural Gas used by each customer on a monthly basis during the study time period. While the quality of some of the historical consumption data was variable, it gave a relatively clear picture of consumption trends. GJs of gas used were compared with "expected" usage.

Put simply, here is how expected usage was calculated:

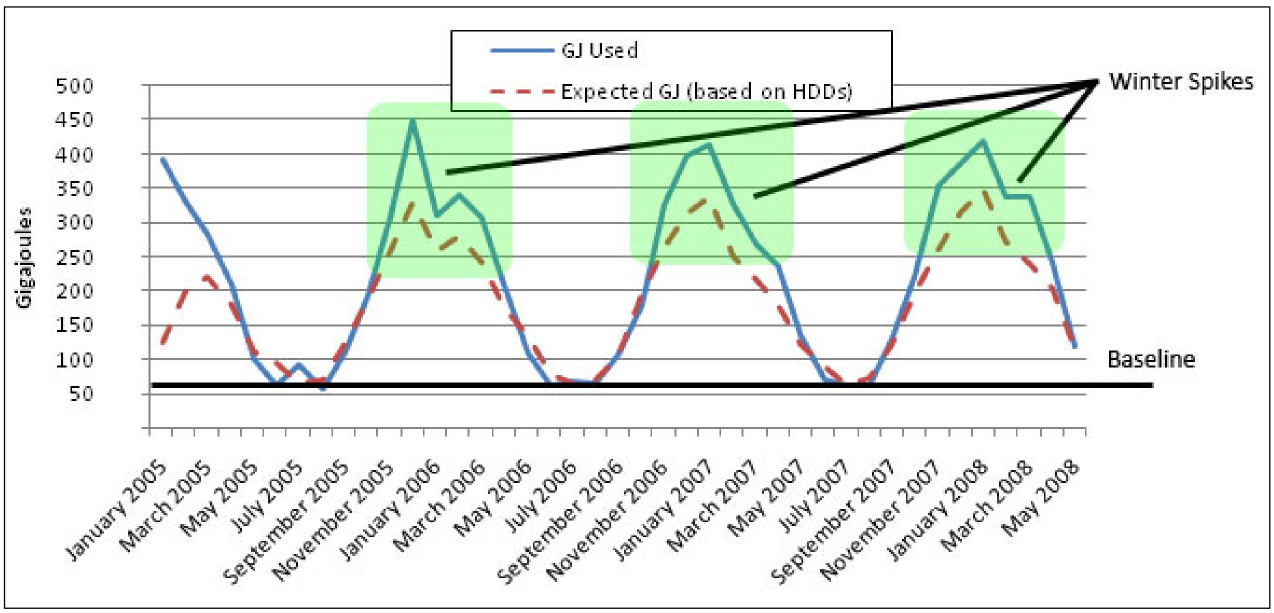
The researcher established a "baseline" of gas usage for each customer in the study. This baseline is the amount of natural gas that the company uses during months where they should not need to turn on the boiler for space heating. Space heating to compensate for outside temperature changes is the biggest cause of consumption variation from month to month.

Figure 4 (below) illustrates how a baseline is established. In July of 2005, 2006 and 2007, both the GJs used and the expected GJs used bottom out at around 60 GJs for those months. This is what the customers' gas consumption looks like when they don't turn on their furnace for a month. All gas consumption that occurs above the baseline is attributed to consumption changes to address colder outside temperatures.

In this specific example, the customer uses more than the expected amount of gas during the winter spikes. This is not uncommon since most customers are not using digital control systems which ramp up heating more incrementally than a person in control of a normal thermostat would. When it's very cold, many people turn the thermostat to a level that is much higher than is necessary under the mistaken impression that it will heat a room faster. The increased demand for gas places on the system by such behavior is illustrated in

Figure 4.

Figure 4: Typical Billing Analysis Chart, Showing Baseline and Winter Spikes



1. Once the baseline was established, the amount of gas used during winter spikes was compared to the baseline. This gave a range of consumption that a business uses based on changes in outside temperature. After looking at the change between low and high heating seasons and comparing to HDDs for three consecutive heating seasons, a multiplier factor can be established to predict how much a customer will turn up the heat when winter cold spikes hit. This information gives the researcher enough data to plot an "expected GJs used" line for each customer to compare against their actual consumption.

2. To compensate for production changes, the expected GJs line was multiplied by 1.n over time where "n" is the percentage increase or decrease in production.

3. The degree to which a customer's actual consumption is above or below the expected GJ use line is compared before and after the Terasen audit. If the customer's consumption rose against expected levels after the audit, it was assumed that the customer did not successfully reduce their natural gas consumption.

4. Customers who have lower consumption against expected levels after implementing recommended changes are counted as having successful outcomes for this program and the amount of GJs they saved below what was expected was counted towards the total GJs saved for this project. For customers who implemented recommended changes but saw an increase or no change in consumption were not counted in this study because their choice to consume more cannot be attributed to the Commercial Energy Assessment Program.

5. Customers who had lower consumption against expected levels but did not implement recommended changes were also counted as having successful outcomes for this program but only 10% of their reduction was added to the total program savings as per the Darby (2001) study[3].

6. Once the analysis showed what customers in each of the different business types saved over what period of time, annual consumption reduction numbers for each category of business could be calculated.

By multiplying average consumption in a business type category by the estimated number of program participants who made the changes before seeing a drop in their consumption, by the number of years on average since this business type participated in the program – this study can arrive at a defensible number of GJs directly averted by the Commercial Energy Assessment program.

FINDINGS

This part of the report summarizes the findings as they match the deliverables specified by Terasen. Analysis of these findings and recommendations to improve on the Commercial Energy Assessment Program will follow in subsequent sections of this report. Where possible, this report will make direct comparisons to the previous program review (completed in August, 2008) – hereafter "the 2005-2007 program review".

Note any distinctions between **respondents** (n=30) and **premises** (n=49) because there were some respondents that gave us information on multiple premises that had received energy assessments.

THE AUDIT EXPERIENCE

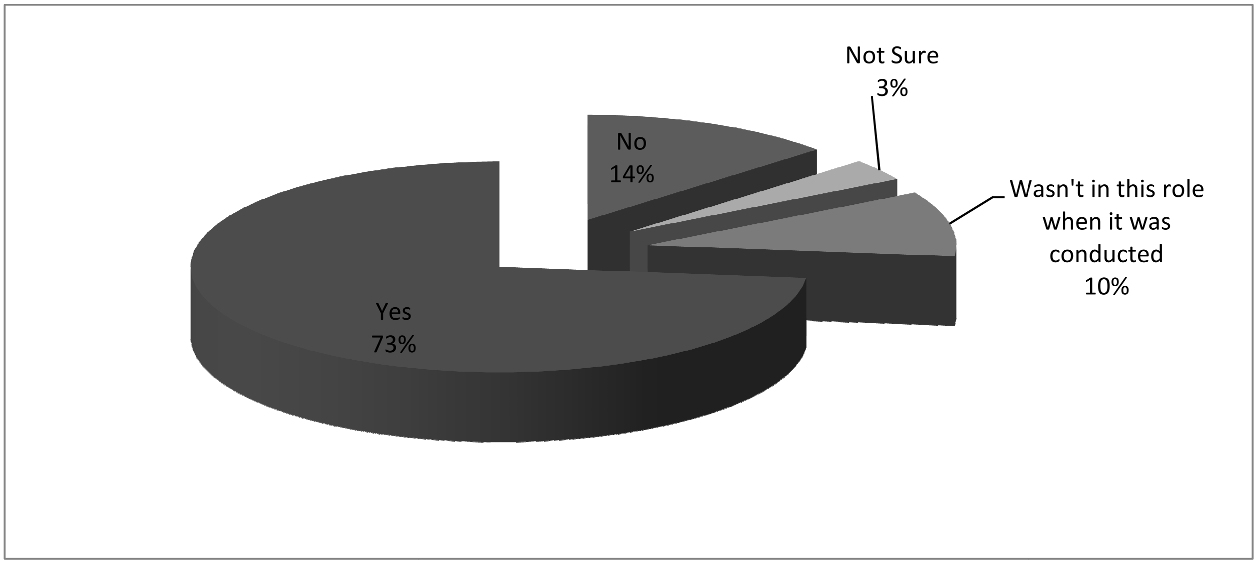
During the process of sourcing respondents for this project, none of the respondents indicated that they had not participated in the program. While not conclusive, it is a good indicator that all of the audits that were said to have been completed between July 2007 and July 2009 were completed.

As part of the follow-up procedure for the audit process, each audit client was to receive an electronic copy of their energy assessment report as well as a follow up phone call from their energy auditor. We interviewed 30 respondents about 49 premises and of these 30 respondents, 22 (73%) stated that they had received their energy assessment report after the completion of their energy audit. Only 14% responded that they hadn't received a copy

[3] Darby, Sarah (2001) "Making it obvious: designing feedback into energy consumption". *Energy Efficiency in Household Appliances and Lighting* (30 January 2001), pp. 685-696.

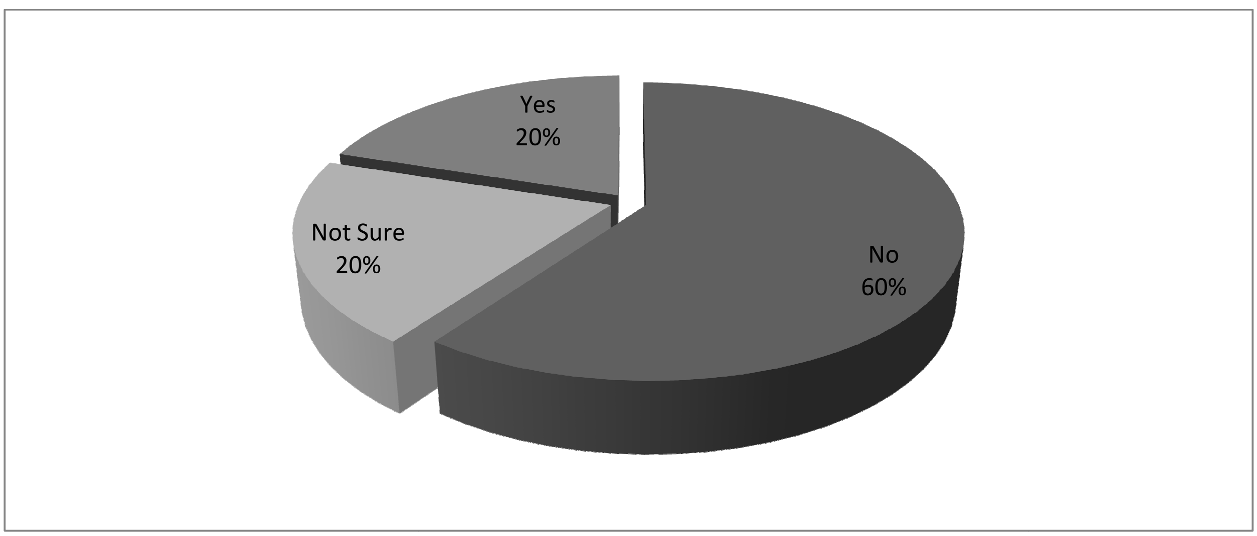
of their energy assessment report. This is an improvement from the 2005-2007 program review, where we had previously found that 20% of respondents hadn't received a copy.

Figure 5: All Respondents; Did You Receive Your Audit Report After The Audit Was Conducted? (N=30)



In terms of follow-up, 6 of 30 respondents (20%) said that they had received a follow-up call from Terasen Gas; 18 respondents (60%) said that they had not (see Figure 6). This is a slight improvement from the 2005-2007 program review, where a full 65% of respondents failed to receive a follow-up after the audit process was completed.

Figure 6: All Respondents; Was There Follow Up from Terasen After The Audit Was Completed? (N=30)



In many cases, the respondent that talked to Friuch Consulting was not the same person who participated in the original audit. This data was captured by asking if the respondent was in the same role as they were when the audit was conducted.

It is worth noting that for those respondents that reported they had not received their audit, it is possible they lost their energy assessments, or that it was delivered to a different department, or filed away and forgotten about. Some of these energy assessments were conducted over two years ago, and many of the respondents are busy building managers who receive a lot of paperwork from different departments. Similarly, it is possible that after the audit a follow-up phone call from Terasen or the Auditor was made and then forgotten about, or that the auditor left messages for the client that weren't returned.

Overall opinions of the audit varied, but generally fell into four categories:

1. **Those who felt the audit was too high level**
2. **Those who were generally satisfied with the overall audit process**
3. **Those who found inaccuracies or generally felt the audit quality was poor**
4. **Those who were not present for the audit process or had a different role in the company at the time of the audit.**

The majority of people audited were satisfied with their audit experience and many said that they had really appreciated the program even if changes weren't made, as it helped present options for them to work towards in the future.

At least one study has shown that the simple act of participating in an energy audit like the Terasen program can introduce a "conservation culture" into a company and result in an average 10% decrease in energy consumption[4]. This phenomenon will be described in greater detail in the section describing our analysis methodology.

However, a significant segment of respondents (13%) felt that the audit process did not meet its full potential because the analysis provided was too high level and/or did not provide enough detail to allow for the smooth implementation of the recommendations. These criticisms were only coming from large public facilities and manufacturing customers. Many of these customers found that they had to hire energy consultants to complete more detailed analyses in order to make the recommended changes. Others felt that the quotes estimating cost of implementation provided were not realistic or lacked enough information to act upon. Many respondents who felt the audits were a bit lean also had positive things to say about the audit but felt the lack of details limited the usefulness of the report.

There were only four (4) respondents who felt the quality was report was "poor". They explained that they found errors in the final report, and were disappointed with the costing calculations that were included. Again, these respondents were in manufacturing and large public facility businesses.

There is no indication that there is a correlation between the 60% of respondents that did not receive any follow-up from Terasen and the relatively low implementation rate amongst program participants (43%). The following sections will demonstrate that there are a number of factors that have an influence in the willingness of a program participant to implement recommended changes to their gas infrastructure and usage.

[4] Darby, Sarah (2001) "Making it obvious: designing feedback into energy consumption". *Energy Efficiency in Household Appliances and Lighting* (30 January 2001), pp. 685-696.

ENERGY SAVINGS

Table 2 gives a high level overview of the energy savings and outcomes experienced by program participants during the study period.

Table 2: Overview of energy savings and outcomes, all groups (n=152)

	Program Participant Premises	Participant Premises Interviewed	Total GJs Saved	Average Savings Per Premises	Premises that experienced a reduction in consumption after audit	%Premises that made recommended changes	% Premises that made recommended changes but did not see a decrease in consumption	% of Premises that did not make recommended changes but saw a decrease in consumption
Apartments/Stratas	26	1	3,064.6	2.60%	insufficient data			
Care Homes	12	4	3,634.1	2.10%	25%	50%	25%	0%
Hotels /Restaurants	15	6	1,089.1	0.68%	50%	50%	0%	0%
Large Public Facilities	47	18	9,901.1	2.19%	55%	44%	22%	33%
Manufacturing	36	13	231,303.9	5%	62%	54%	8%	23%
Offices	16	7	755.5	0.84%	43%	0%	0%	43%
Total	**152**[5]	**49**	**249,748.3**	**2.63%**	**52%**	**43%**	**13%**	**24%**

The above table illustrates how Manufacturing customers far outstripped the other sectors combined in terms of GJs of energy saved. The manufacturing sector is responsible for 92% of the total GJs reduced in this study while representing only 23% of the total program participant premises. This sector also had the highest implementation rate of recommended changes. The following sections will dive into the findings for each business types with regards to GJs of energy use averted.

[5] Npte: This total excludes "warehousing" and "other" respondents. There was insufficient data to analyze these business types.

APARTMENTS/STRATAS

The response rate for this category was very poor. The researcher tasked with scheduling interviews was unable to find a sufficient number of property managers to speak with in this category. There were 26 apartment/strata customers in the study sample – all of whom were contacted multiple times to complete this research.

The target for this category was to speak to eight (8) customers out of 26 (~30%) and Friuch was only able to contact one (1). Seven (7) interviews were scheduled but a number of them did not make their interview appointment and in all cases, did not make re-scheduled interviews. While this is not a good outcome, it does not mean that the findings for this business type are useless.

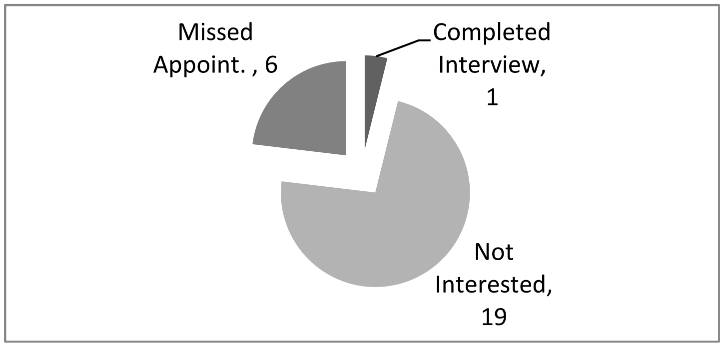


Figure 7: Response rate statistics - Apartments/Stratas (N=26)

During the 2005-2007 program review, this respondent group had a relatively high rate of implementing changes (56%) but had very little impact in terms of GJs of gas saved for two reasons: first, the average annual consumption for these program participants is very low compared to other program participants – in manufacturing, for example. Secondly, many of these kinds of properties lack healthy capital budgets to fund the recommended upgrades. Only 60% of Apartments/Stratas from the last study managed to reduce their consumption after making changes.

While it would be easier to apply the same change metrics from the previous study to this under-represented group in this study, there are a number of factors that lead the researchers to believe this would not result in an accurate review:

1. One of the most cited reasons for not doing major changes in the previous study was that major upgrades would require a special assessment fee to residents/owners that they were unwilling to pay. Given the province-wide decline in home values in 2008/2009 and the economic downturn of 2009, home owners may have been more resistant to spending money on major heating infrastructure upgrades during the study period.

   Put another way, the economic downturn may have made customers less willing to pay for new boilers and other upgrades. None of the respondents indicated that their "operations" were impacted by the economic downturn but that has a much different connotation for property managers of residential buildings than it does for the manufacturing companies interviewed.

2. 85% of the recommendations made to Apartments/Stratas in this study period were for "minor tweaks" (e.g. adjusting boiler settings, resetting thermostats, monitoring usage, etc…) or to replace a functioning boiler with a higher efficiency one when it fails. These recommendations are easy to follow and are more oriented towards introducing a "conservation culture" to the customer than making any major changes. . Studied have shown that the simple act of

participating in an energy audit like the Terasen program can introduce a "conservation culture" into a company and result in an average 10% decrease in energy consumption[6]. We did not account for this in our previous study but did in this study.

Comparable data from the previous study from which to make a direct comparison is not available. In the last study, Friuch only collected consumption data for respondents. After going back and running a more detailed analysis on the data from the previous study, it was discovered that Apartments/Stratas from the 2005-2007 program review reduced their consumption by an average of 2.88% after participating in the program. The sole apartment/strata respondent (who did not apply the recommended changes to their premises) saved 2.6% of their average annual consumption. This reduction percentage has already factored in the 10% of the GJ reduction Terasen can take credit for according to the Darby study. Total GJs below expected consumption post-audit was 524.83 GJ. Terasen is only taking credit for 52.483 GJs.Table 3: Data collected from respondents: Apartments/Stratas (n=1)

Participant ID	Months since audit to Nov. 2009	Implemented Changes?	Consumption Up/Down?	Raw GJs Saved	Average GJs Saved per year	Average Consumption Per Year Prior to Audit	Average GJ Savings %
113	12	No	Down	52.5	52.5	2020	2.60%

We are assuming an average savings since audit of 2.6%. Despite a sample size of only one, we are confident in this rate of savings because it is roughly in keeping with the average savings from the last study of 2.8%. The following table shows what happens when we apply this rate evenly to the program participants from the study period that we did not interview.

Table 4: Application of Average Savings to non-respondent program participants (n=25)

Participant ID	Date of Audit	Average Annual Consumption (GJs)	GJs Consumed since audit	Raw GJs Saved Since Audit	Average Annual GJs Saved
1	Jul-07	2033.8	4305.0	111.9	48.0
12	Aug-07	4126.7	12331.9	320.6	142.5
61	Mar-08	3087.6	5464.5	142.1	85.2
65	Apr-08	2424.1	3709.4	96.4	60.9
66	Apr-08	6640.2	11205.8	291.4	184.0
81	Jun-08	588.3	877.8	22.8	16.1
98	Sep-08	1777.4	1984.4	51.6	44.2
106	Oct-08	70.5	97.8	2.5	2.3
107	Oct-08	8358.8	10327.2	268.5	247.9
108	Oct-08	4164.1	6420.7	166.9	154.1

[6] Darby, Sarah (2001) "Making it obvious: designing feedback into energy consumption". *Energy Efficiency in Household Appliances and Lighting* (30 January 2001), pp. 685-696.

Participant ID	Date of Audit	Average Annual Consumption (GJs)	GJs Consumed since audit	Raw GJs Saved Since Audit	Average Annual GJs Saved
121	Nov-08	2255.0	2323.9	60.4	60.4
122	Nov-08	6838.7	8631.7	224.4	224.4
123	Nov-08	2688.7	2929.4	76.2	76.2
124	Nov-08	2860.2	3414.2	88.8	88.8
125	Nov-08	7623.6	8810.8	229.1	229.1
127	Dec-08	3667.0	4346.7	113.0	123.3
134	Jan-09	4514.0	4165.1	108.3	130.0
137	Feb-09	9887.0	8721.3	226.8	302.3
146	Apr-09	3356.9	1811.0	47.1	80.7
147	May-09	4552.2	2625.8	68.3	136.5
150	Jun-09	2352.8	1048.8	27.3	65.4
151	Jun-09	13097.0	4591.9	119.4	286.5
152	Jun-09	3195.8	1588.6	41.3	99.1
153	Jun-09	7625.1	2932.6	76.2	183.0
157	Jul-09	2949.5	1182.1	30.7	92.2
	Totals	**110735.0**	**115848.4**	**3012.1**	**3163.3**
	Average	**4429.4**	**4633.9**	**120.5**	**126.5**
	Median	**3356.9**	**3709.4**	**96.4**	**99.1**

If we add these totals together, we see that the raw savings for this business type during the study period was 3,064.6 GJs. The difference in consumption between these customers is likely the result of the size of the complexes which can range from 60 units (with gas used only for hot water and hallway heating) to 161 units (with an inefficient system used for unit space heating and hot water heating).

CARE HOMES

The response rate for this business type was adequate. The target for this category was to speak to four (4) customers out of 11 (~36%) and Friuch was able to interview four (4). 50% of the respondent premises for this category made some or all of the recommended changes resulting in an average consumption reduction of 8.39%. Average reduction from the previous study is 4.39%.

Table 5: Data Collected from Care Homes (n=4)

Participant ID	Months since audit to Nov. 2009	Implemented Changes?	Consumption Up/Down?	Raw GJs Saved	Average GJs Saved per year	Average Consumption Per Year Prior to Audit	Average GJ Savings %
4	28	No	Up	0			
5	28	No	Up	0			
7	28	Yes	Up	0			
14	27	Yes	Down	2239.3	995.3	11861	8.39%

Table 5 reveals that despite a 50% implementation rate, only 25% of respondents experienced a positive outcome (reduced GJs). The one respondent did experience an average savings of 8.39% but since only one out of four respondents actually experienced a positive outcome, that reduction will be multiplied by the positive outcome rate to generate a reduction percentage specific to program participants who did not get interviewed: **(8.39% * 25%) = 2.1%.** The following table shows what happens when we apply this rate (2.1%) evenly to the program participants from the study period that we did not interview:

Table 6: Application of Average Savings to non-respondent program participants (n=8)

Participant ID	Date of Audit	Average Annual Consumption (GJs)	GJs Consumed since audit	Raw GJs Saved Since Audit	Average Annual GJs Saved
6	Jul-07	2234.7	5188.0	108.9	46.7
13	Aug-07	3960.0	9860.3	207.1	92.0
15	Aug-07	2581.0	8669.6	182.1	80.9
18	Aug-07	5922.9	15062.4	316.3	140.6
39	Nov-07	3594.0	6483.6	136.2	68.1
57	Jan-08	4409.9	13309.0	279.5	152.4
58	Jan-08	1707.1	4547.3	95.5	52.1
64	Apr-08	2082.5	3299.8	69.3	43.8
Totals		**26492.1**	**66420.0**	**1394.8**	**676.6**
Average		**3311.5**	**8302.5**	**174.4**	**84.6**
Median		**3087.5**	**7576.6**	**159.1**	**74.5**

If we add these totals together, we see that the raw savings for this business type during the study period was 3,634.1 GJs.

HOTELS/RESTAURANTS

The response rate for this business type was adequate. The target for this category was to speak to five (5) program participants out of 15 (~30%) and Friuch was able to interview six (6) program participants. 50% of the respondents for this category made some or all of the recommended changes resulting in an average consumption reduction of 1.36%. Average reduction from the previous study is 2.5%.

Table 7: Data Collected from Hotels/Restaurants (n=6)

Participant ID	Months since audit to Nov. 2009	Implemented Changes?	Consumption Up/Down?	Raw GJs Saved	Average GJs Saved per year	Average Consumption Per Year Prior to Audit	Average GJ Savings %
9	28	Yes	Down	204.9	87.81	5869	1.50%
10	27	No	Up	0			
19	26	Yes	Down	206.9	95.49	10463	0.91%
40	24	No	Up	0			
41	24	No	Up	0			
45	23	Yes	Down	208.55	108.81	6502	1.67%
			Totals	**620.4**	**292.1**	**22834.0**	
			Average	**206.8**	**97.4**	**7611.3**	
			Median	**206.9**	**95.5**	**6502.0**	

Table 7 (above)Table 5 shows what we would expect to see for most categories – a direct relationship between premises that implemented recommended changes and a corresponding positive outcome (reduced GJs). That reduction (1.36%) will be multiplied by the positive outcome rate to generate a reduction percentage specific to program participants who did not get interviewed: **(1.36% * 50%) = 0.68%.** The following table shows what happens when we apply this rate (0.68%) evenly to the program participants from the study period that we did not interview:

Table 8: Application of Average Savings to non-respondent program participants (n=9)

Participant ID	Date of Audit	Average Annual Consumption (GJs)	GJs Consumed since audit	Raw GJs Saved Since Audit	Average Annual GJs Saved
38	Nov-07	7131.4	15669.6	106.6	53.3
46	Dec-07	2756.8	5964.7	40.6	21.2

47	Dec-07	4742.1	10830.7	73.6	38.4
56	Dec-07	3866.5	7814.9	53.1	27.7
77	May-08	4321.9	6449.5	43.9	29.2
78	May-08	2073.9	3671.8	25.0	16.6
92	Aug-08	3142.0	6900.6	46.9	37.5
93	Aug-08	5172.0	7065.4	48.0	38.4
95	Sep-08	3816.1	4558.2	31.0	26.6
	Totals	**37022.7**	**68925.4**	**468.7**	**289.0**
	Average	**4113.6**	**7658.4**	**52.1**	**32.1**
	Median	**3866.5**	**6900.6**	**46.9**	**29.2**

If we add these totals together, we see that the raw savings for this business type during the study period was 1089.1 GJs.

LARGE PUBLIC FACILITIES

The response rate for this business type was good. The target for this category was to speak to 15 customers out of 47 (~30%) and the researchers were able to interview 18. 44% of the respondents for this category made some or all of the recommended changes resulting in an average consumption reduction of 3.98%. This average reduction is in sharp contrast to the reduction from the previous study - 12%.

Table 9: Data Collected from Large Public Facilities (n=18)

Participant ID	Months since audit to Nov. 2009	Implemented Changes?	Consumption Up/Down?	Raw GJs Saved	Average GJs Saved per year	Average Consumption Per Year Prior to Audit	Average GJ Savings %
11	27	Yes	Down	275.9	122.6	719.0	0.2
23	26	No	Down	78.3	36.1	6537.0	0.0
24	26	Yes	Down	181.1	83.6	2650.0	0.0
27	26	Yes	Up	0.0			
42	23	Yes	Up	0.0			

Participant ID	Months since audit to Nov. 2009	Implemented Changes?	Consumption Up/Down?	Raw GJs Saved	Average GJs Saved per year	Average Consumption Per Year Prior to Audit	Average GJ Savings %
50	23	No	Up	0.0			
51	23	Yes	Down	70.4	36.7	8509.0	0.0
52	23	Yes	Down	2901.9	1514.0	11403.0	0.1
53	23	Yes	Up	0.0			
99	14	No	Up	0.0			
104	14	No	Down	141.4	121.2	5689.0	0.0
112	13	No	Statistically Insignificant Changes				
114	12	No	Down	23.4	23.4	2731.0	0.0
115	12	No	Down	56.8	56.8	3971.0	0.0
116	12	No	Down	23.4	23.4	3894.0	0.0
117	12	No	Down	7.4	7.4	2252.0	0.0
132	11	No	Up	0.0			
133	11	Yes	Up	0.0			
			Total	**3760.0**	**2025.3**	**48355.0**	
			Average	**376.0**	**202.5**	**376.0**	
			Median	**74.3**	**46.8**	**74.3**	

Table 9 (above)Table 5 reveals that there is a disconnect between premises that implemented the recommended changes (44%) and those premises that experienced a positive outcome (55%). The 3.98% average reduction across these premises will be multiplied by the positive outcome rate to generate a reduction percentage specific to program participants who did not get interviewed: **(3.98% * 55%) = 2.19%.**

The following table shows what happens when we apply this rate (2.19%) evenly to the program participants from the study period that we did not interview:

Table 10: Application of Average Savings to non-respondent program participants (n=29)

Friuch ID	Date of Audit	Average Consumption Per Year	GJ Cons since audit	Raw GJs Saved	Average Savings per year
2	Jul-07	1116.0	2909.5	63.7	27.3
25	Sep-07	6563.3	19879.2	435.4	200.9
48	Dec-07	5418.9	11647.4	255.1	133.1
60	Mar-08	2914.5	3620.5	79.3	47.6

Friuch ID	Date of Audit	Average Consumption Per Year	GJ Cons since audit	Raw GJs Saved	Average Savings per year
62	Mar-08	22878.3	21235.1	465.0	279.0
63	Mar-08	17926.5	24635.6	539.5	323.7
67	Apr-08	377.3	983.3	21.5	13.6
70	May-08	7314.7	8982.4	196.7	131.1
79	May-08	4701.4	6509.3	142.6	95.0
82	Jun-08	45121.0	62782.4	1374.9	970.5
87	Jul-08	2989.0	3036.6	66.5	49.9
94	Sep-08	2284.9	3098.8	67.9	58.2
96	Sep-08	5481.7	7377.3	161.6	138.5
97	Sep-08	1860.5	2020.9	44.3	37.9
101	Sep-08	9093.3	11772.0	257.8	221.0
102	Sep-08	5812.3	7668.4	167.9	143.9
103	Sep-08	11959.4	16102.4	352.6	302.3
110	Oct-08	3693.3	4107.6	90.0	83.0
118	Nov-08	3636.3	4161.2	91.1	91.1
119	Nov-08	1666.6	2093.9	45.9	45.9
120	Nov-08	2555.1	3638.8	79.7	79.7
129	Dec-08	22092.0	26254.5	575.0	627.2
130	Dec-08	1772.6	2708.9	59.3	64.7
131	Dec-08	1789.9	1640.8	35.9	39.2
138	Feb-09	11215.6	8340.9	182.7	243.6
154	Jul-09	6610.7	2133.8	46.7	140.2
155	Jul-09	6379.0	2532.1	55.5	166.4
156	Jul-09	955.8	1733.8	38.0	113.9
158	Jul-09	73174.5	6808.9	149.1	447.3
	Totals	**289354.3**	**280416.2**	**6141.1**	**5315.8**
	Average	**9977.7**	**9669.5**	**211.8**	**183.3**
	Median	**5418.9**	**4161.2**	**91.1**	**131.1**

If we add these totals together, we see that the raw savings for this business type during the study period was 9901.1 GJs.

MANUFACTURING

The response rate for this business type was good. The target for this category was to speak to 11 customers out of 37 (~30%) and the researchers were able to interview 13.

Table 11: Data collected from manufacturing premises (n=13)

Participant ID	Months since audit to Nov. 2009	Implemented Changes?	Consumption Up/Down?	Raw GJs Saved	Average GJs Saved per year	Average Consumption Per Year Prior to Audit	Average GJ Savings %
20	26	Yes	Up	0.0			
21	26	Yes	Down	130219.0	60101.1	581753.0	10.33%
37	24	Yes	Down	408.7	204.3	2763.0	7.40%
49	23	Yes	Down	11658.8	6082.9	21551.0	28.23%
54	23	No					Data not conducive to analysis
68	19	Yes					Data not conducive to analysis
69	19	No	Up	0.0			
74	18	No	Down	117.9	78.6	8864.0	0.89%
128	11	Yes	Down	1996.6	2178.1	39579.0	5.50%
135	10	Yes	Down	464.5	557.4	23997.0	2.32%
139	9	No	Down	798.2	1064.2	12477.0	8.53%
145	8	No	Down	108.2	162.2	11836.0	1.37%
148	6	No	Up	0.0			
			Totals	**145771.7**	**70428.8**	**145771.7**	
			Average	**18221.5**	**8803.6**	**18221.5**	
			Median	**631.3**	**810.8**	**631.3**	

Table 11 (above)Table 5 reveals that there is a disconnect between premises that implemented the recommended changes (54%) and those premises that experienced a positive outcome (62%). The 8.07% average reduction across these premises will be multiplied by the positive outcome rate to generate a reduction percentage specific to program participants who did not get interviewed: **(8.07% * 62%) = 5%**

The following table shows what happens when we apply this rate (5%) evenly to the program participants from the study period that we did not interview:

Table 12: Application of Average Savings to non-respondent program participants (n=23)

Friuch ID	Date of Audit	Average Consumption Per Year	GJ Cons since audit	Raw GJs Saved	Average Savings per year
84	Jul-08	3088.1	4272.5	213.6	160.2
16	Aug-07	6127.8	11750.0	587.5	261.1
17	Aug-07	12280.7	38360.2	1918.0	852.4
28	Oct-07	41035.9	77081.3	3854.1	1850.0
28	Oct-07	9620.2	23546.3	1177.3	565.1
28	Oct-07	24650.1	54460.2	2723.0	1307.0
28	Oct-07	4487.0	10068.5	503.4	241.6
28	Oct-07	92311.9	358514.3	17925.7	8604.3
28	Oct-07	3447.0	10336.9	516.8	248.1
28	Oct-07	12036.0	20133.1	1006.7	483.2
28	Oct-07	14882.7	39612.5	1980.6	950.7
28	Oct-07	4349.2	9906.5	495.3	237.8
73	May-08	17987.2	18392.4	919.6	613.1
75	May-08	59775.1	95494.2	4774.7	3183.1
80	Jun-08	983587.3	346069.1	17303.5	12214.2
83	Jul-08	1552.0	1620.0	81.0	60.7
85	Jul-08	160255.9	176227.9	8811.4	6608.5
91	Aug-08	347241.6	227494.7	11374.7	9099.8
105	Sep-08	127405.4	136692.9	6834.6	5858.3
136	Feb-09	640.0	448.6	22.4	29.9
140	Feb-09	37377.8	37241.4	1862.1	2482.8
141	Feb-09	12477.0	7991.3	399.6	532.8
142	Feb-09	3614.1	4929.5	246.5	328.6

Friuch ID	Date of Audit	Average Consumption Per Year	GJ Cons since audit	Raw GJs Saved	Average Savings per year
	Totals	1980230.0	1710644.2	85532.2	56773.4
	Average	86097.0	74375.8	3718.8	2468.4
	Median	12477.0	23546.3	1177.3	613.1

If we add these totals together, we see that the raw savings for this business type during the study period was 231,303.9 GJs.

OFFICE

The response rate for this business type was good. The target for this category was to speak to five (5) customers out of 17 (~30%) and the researchers were able to interview seven (7).

Table 13: Data collected from Office Premises (n=7)

Participant ID	Months since audit to Nov. 2009	Implemented Changes?	Consumption Up/Down?	Raw GJs Saved	Average GJs Saved per year	Average Consumption Per Year Prior to Audit	Average GJ Savings %

8	28	No	Up	0			
22	26	No	Up	0			
43	23	No	Up	0			
44	23	No	Down	181.3	94.6	2155.0	4.39%
55	23	No	Down	7.4	3.9	4073.0	0.09%
59	20	No	Up	0			
100	14	No	Down	68.9	59.1	4177.0	1.41%
			Totals	**257.6**	**157.5**	**10405.0**	
			Average	**85.9**	**52.5**	**3468.3**	
			Median	**68.9**	**59.1**	**4073.0**	

Table 13 (above)Table 5 is a prime example of this often-seen phenomenon in this study – respondents who did not implement any of the recommended changes but still saw positive outcomes in the form of reduced gas consumption. Even without instances of implemented changes, we can base our analysis on the positive outcomes experienced by respondents. The 1.96% average reduction in consumption experienced by respondents that is attributable to the influence of the audit will be multiplied by the positive outcome rate to generate a reduction percentage specific to program participants who did not get interviewed: **(1.96% * 43%) = 0.84%**

The following table shows what happens when we apply this rate (0.84%) evenly to the program participants from the study period that we did not interview:

Table 14: Application of Average Savings to non-respondent program participants (n=9)

Friuch ID	Date of Audit	Average Consumption Per Year	GJ Cons since audit	Raw GJs Saved	Average Savings per year
3	Jul-07	2114.5	4664.1	39.2	16.8
71	May-08	3527.1	5837.6	49.0	32.7
72	May-08	1576.1	2038.9	17.1	11.4
76	May-08	24238.3	27607.0	231.9	154.6
86	Jul-08	377.2	976.9	8.2	6.2
88	Jul-08	4878.1	7080.7	59.5	44.6
89	Jul-08	2337.5	4415.8	37.1	27.8
90	Aug-08	2586.1	3081.6	25.9	20.7

143	Mar-09	10542.3	3575.7	30.0	45.1
	Totals	**52177.3**	**59278.3**	**497.9**	**359.8**
	Average	**5797.5**	**6586.5**	**55.3**	**40.0**
	Median	**2586.1**	**4415.8**	**37.1**	**27.8**

If we add these totals together, we see that the raw savings for this business type during the study period was 755.5 GJs.

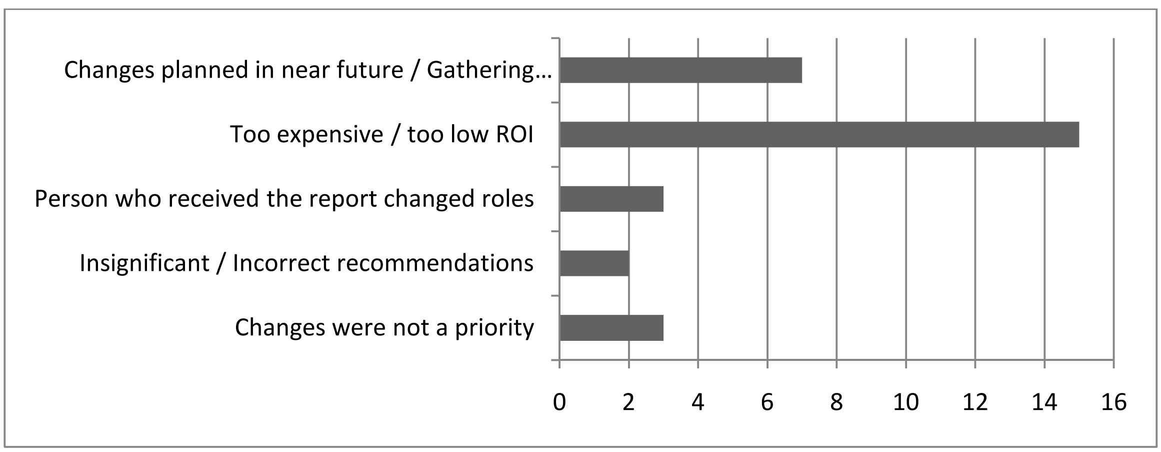
QUALITATIVE DATA

This section of the report reports on the coded findings derived from qualitative data collected during the interviews. The main source of this qualitative data is clarifying questions that were asked during the interviews.

Respondents who did not make changes listed a variety of reasons for why changes were not made: Fifteen (15) respondents found that the recommended changes were too expensive or had an ROI that was simply too low to take on the capital expense. Seven (7) respondents were in the process of making changes or gathering more information in preparation for a change in the near future.

In cases where audits were completed in the summer of 2009, the process of purchasing capital expenses like a new boiler may fall under a one year plan and may not yet have been implemented. In three (3) cases, despite a reasonable ROI, the recommended changes failed to be a priority for respondents due to more pressing issues. In one of these cases, the economic downturn had created enough uncertainty in the company such that all major expenses were frozen so as to keep the company as liquid as possible. In these cases, short term survival is more pressing then long term investment.

Figure 8: Respondents Who Did Not Make Recommended Changes, Reasons for Not Making Changes, by premises (N=30)



Many respondents who could not make substantial capital investments recommended in the energy assessment report did in fact make small improvements due to the audit process. For example, one post-secondary institution was not able to make any of the large changes recommended due to budget constraints, but following the assessment did end up making a significant effort to make small, less capital-intensive changes such as reviewing the schedules on their HVAC systems and adjusting their makeup air units.

In another example, a hotel could not justify the cost of a thermostat upgrade that was recommended but has been instead been manually turning down the roof heating system as a way to save money. Yet another example saw a manufacturing company that was not able to afford the upgrades recommended but did weather-strip all the doors and windows in their facility to save energy after the audit. From speaking with those who went through the process, it seems that even if the recommended changes couldn't be implemented, the audit process had a secondary benefit of stirring discussion on sustainability and the potential to save money by saving energy, heat and gas.

As mentioned earlier in the report, there is a precedent to assume that the introduction of a "conservation culture" during the assessment process will cause some participants to reduce their consumption by a noticeable amount. The abstract of the Darby (2001)[7] paper reads:

> The paper reviews the literature on the effectiveness of three types of feedback to domestic consumers: direct feedback in the home, indirect feedback via billing and 'inadvertent' feedback (a by-product of technical, household or social changes). The lessons learned on the importance of clear, immediate and user-specific information are then applied in a survey of the opportunities for better feedback to consumers in terms of technology, design and location of meters and display panels, energy billing **and services such as audits and advice programmes**.
>
> The paper concludes that feedback has a significant role to play in raising energy awareness and in bringing about reduced consumption of the order of 10%; and that opportunities exist for designing it into energy-related systems which have yet to be realised.

This should account for circumstances where a participant claims to have not implemented any of the recommended changes but manages to reduce their natural gas consumption by a significant amount.

Those respondents who did make changes were generally very satisfied with their results. Out of the 19 respondent premises that made significant changes, 16 said that they were very happy with the changes that they had made. The remaining three (3) firms said that they were not yet sure if they were happy because they were still waiting on more information as to the extent of their energy savings. As some of these implementations were still quite recent (less than six months), some of the respondents had yet to see full results from their investments.

Table 2 shows the frequency that respondents made recommended changes at their premises by specific changes recommended. These recommendations have been coded for simpler analysis as follows:

1. **Major Upgrade**. This refers to a major capital investment to upgrade or retrofit a piece of HVAC hardware or process heating system. For example: "replace aging boilers with staged, wall-mounted boilers" or "replace direct-fired drying oven furnace with redirected waste heat from main process heat boiler".
2. **Minor Tweaks**. This refers to minor adjustments to existing equipment. For example: "calibrate thermostats" or "reset timer on makeup air unit so that when it comes one, it only runs for 15 minutes instead of 30".
3. **No Recommendations**. This is when an assessment comes to the conclusion that there are no possible improvements to recommend.
4. Replace Boiler with Higher Efficiency Boiler when Fails. These are recommendations made about existing boilers that are, while inefficient, relatively new and in good working order. It's meant to say that when the boiler does fail (even if it is in 20 years); there is an incentive to upgrade to a higher efficiency boiler with a shorter ROI payback than replacing a working boiler with a new one.

Despite the apparent impact of the economic downturn, this study saw more participants making major upgrades to their HVAC and process heating equipment than the 2005-2007 program review. Obviously, when no changes are recommended, there is no opportunity to change.

Table 15: Frequency of Recommended Change Implementation, by (Coded) Type of Change Recommended (N=49)

Recommended Change	# of respondent premises where	# of respondent premises where	Percentage

[7] Darby, Sarah (2001) "Making it obvious: designing feedback into energy consumption". *Energy Efficiency in Household Appliances and Lighting* (30 January 2001), p. 685.

	changes were made	changes were made	
Major Upgrade	18	8	42%
Minor Tweaks	13	4	31%
No Recommendations	3	0	0%
Replace Boiler with highE Boiler when fails	15	3	20%
Total	**49**	**15**	

BARRIERS TO IMPLEMENTING RECOMMENDED CHANGES

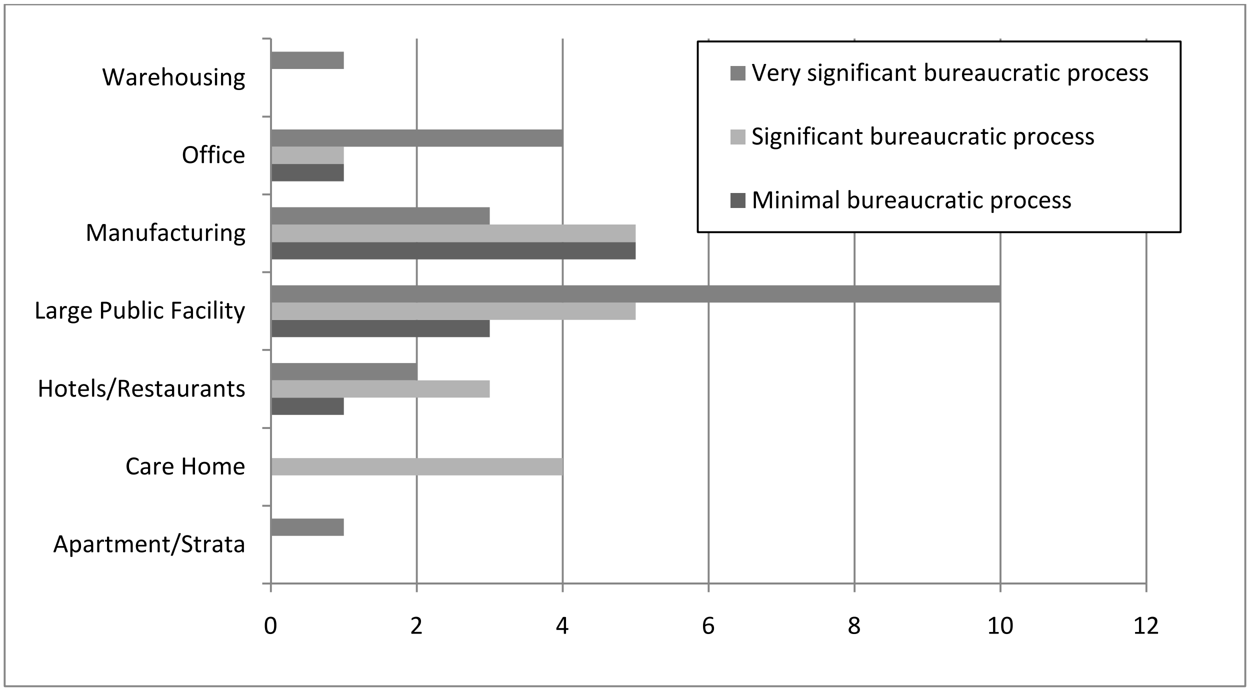
In most cases, managers who participated in the Terasen assessments had no direct authority over capital expenditures. In order to implement the recommended changes company owners, senior managers or (in the case of public facilities) government offices must be petitioned by a strong organizational champion who can articulate why and how the changes should be implemented. There are two main barriers to this process:

- **The ability of the organizational champion to promote this cause, and**
- **The level of bureaucracy to implement a capital purchase**

Organizations who put forward respondents in a significant position of authority and who had the time to champion the cause of implementing the audit recommendations were met with higher levels of success. For example, a post-secondary education institution had a specific groundskeeper who was focused on sustainability and conservation that championed all activities designed to save gas, energy and money around campus. This individual contributed to the success of this participants energy conservation measures by applying for government funding for the recommended changes. Other post-secondary institutions lacked a strong internal advocate in this kind of a position and found they were unable to access the same funding.

In terms of organizational bureaucracy, (as assessed by responses to an interview question which asked participants to describe the process through which their organization must go through to get an upgrade like the one recommended to them implemented) those organizations that have a less bureaucratic process for making capital purchases will have a higher chance of the audit recommendations being implemented. As can be seen in Figure 9 below, the manufacturing industry has a consistently lower bureaucratic decision-making structure, and as can be seen in **Error! Reference source not found.** above, when broken down by business type, "manufacturing" had the highest level of implementation.

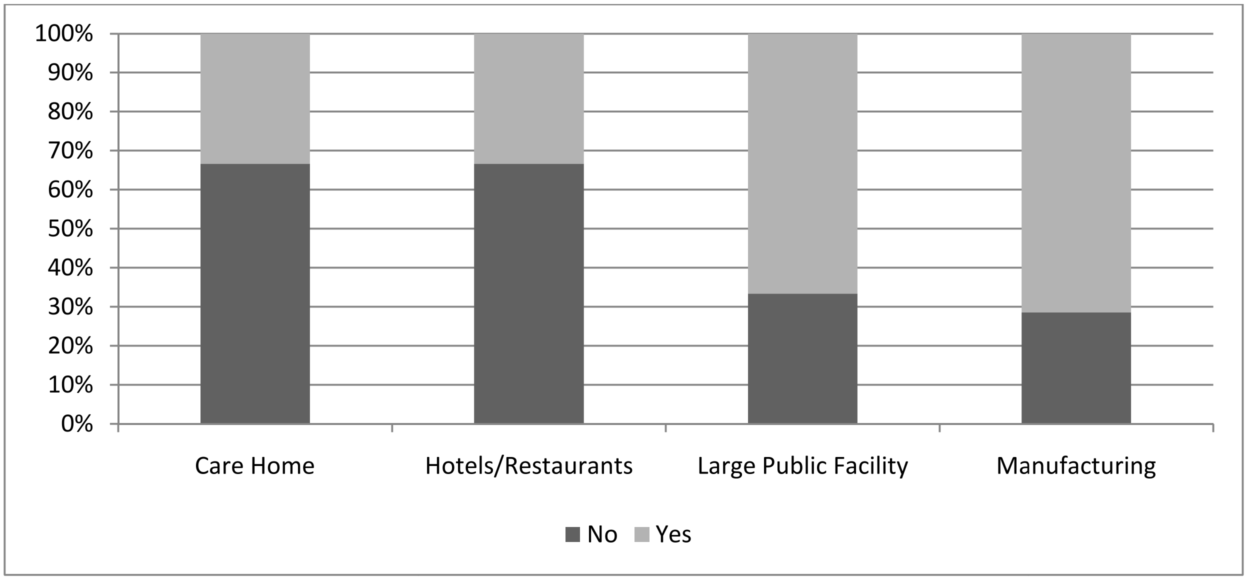
Figure 9: All Respondents, Degree of Bureaucracy in Making Capital Expenditures; By Industry (N=49)



58% of respondents who had made changes also tracked their energy savings after changes were made. Manufacturing industries and large public facility were most proportionately concerned with tracking their savings after changes were implemented, which suggests that in these industries ROI was more frequently a significant factor in making changes than in other industries. In businesses where the customer uses more GJs of gas per month than others, small efficiencies gained on the shop floor can dramatically affect the marginal cost of the product being produced.

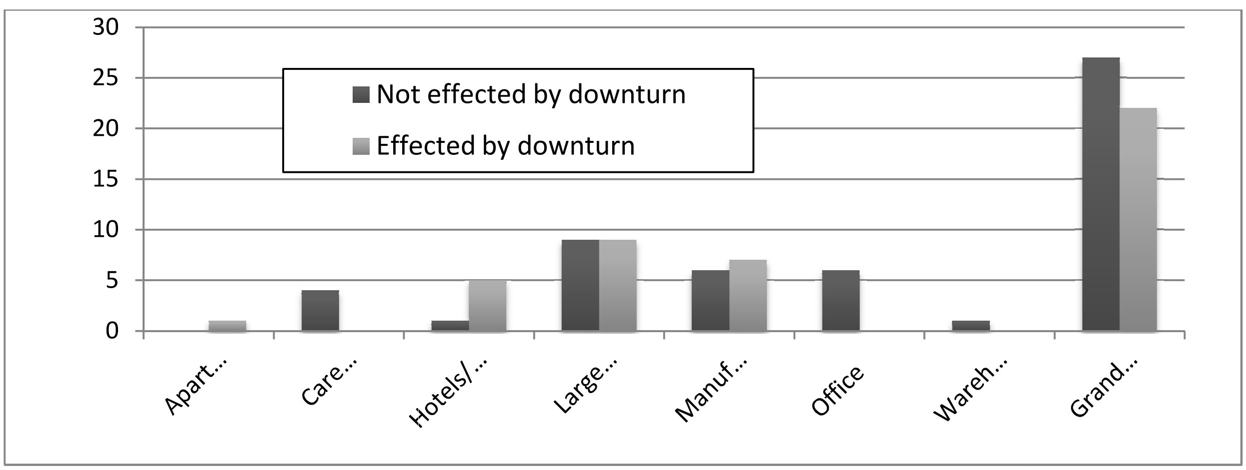
As such, manufacturing companies and any customers that use closer to $100,000 worth of gas per month have the most to gain from these kinds of programs because the ROI on any changes would be much shorter than it would be for care homes and apartments. In the case of a care home or a hotel, changes are likely made on the basis of a proposal that lists a very short ROI (less than three years) or based on need if a boiler breaks down and a new one needs to be installed. These energy savings are incidental to the core business at hand and so therefore for many managers, the task of monitoring gas usage reductions will not be a high priority.

Figure 10: Premises That Made Changes, Frequency of Tracking Energy Savings After Changes Were Made; By Industry (N= 19)



One of the questions in the interview asked if respondents' premises had been affected by the economic downturn. Their responses (see Figure 11) show that Large Public Facilities and Manufacturing customers were nearly evenly divided in their responses. Hotels/Restaurants were deeply impacted by the economy while Offices and Care Homes were largely unaffected.

Figure 11: Respondent Premises, Affected by Economic Downturn or Not (N=49)



The researchers tried to correlate the impact of the economic downturn to respondents' answers about production and operations fluctuations but there was none to be found. For example, some manufacturing companies who claimed to be negatively impacted by the economic downturn saw major production increases – a counterintuitive result.

FREE RIDERS

One measure of the cost effectiveness of a program is a "free rider" analysis looking at program participants who accepted the audit service from Terasen at no cost to them when they would willingly pay for the service if it were not free.

For the purposes of this study, energy savings can be calculated from billing analysis alone. In the case of the Commercial Energy Assessment Program, accurate free rider analysis is clouded by Terasen's business practice of offering free audits partly as a customer satisfaction tool. It is likely that the majority of customers in this study likely participated in the program because Terasen Gas and its sub-contractors encouraged customers to participate in the program.

The option to pay for the audits was not made available to customers. For these reasons, it is the belief of Friuch Consulting that any conclusions drawn from this free rider analysis are notional at best.

Table 16 shows the percentage of "free riders" in each business category. This number is derived by dividing the number of study respondents who conducted other assessments on their business that were not subsidized at all by the number of study participants in a specific business type contacted for this research. See question 15 in Appendix A.

For example, a customer who participated in the Commercial Energy Program might have also conducted a self-funded lean manufacturing assessment to reduce operating costs or increase operating efficiencies. In either case, the customer shows a willingness to invest resources in efficiency and productivity increases. That percentage of free riders is extrapolated into a total number of free riders by business type in the last column by multiplying the number of program participants (N=158) by the percentage of free riders for that category.

Table 16: Free Ridership, by Type of Business (n=158)

Type of Business	# of Program Participants	% free riders	# Free riders (mid-2005 to June 2007, est.)
Care Homes	11	0%	0
Manufacturers	27	62%	17
Apartments/Strata Properties	*26*	*100%*[8]	*26*
Hotels/Restaurants	15	66%	10
Large Public Facility	58	38%	22
Offices	16	43%	7
Warehousing	5	0%	0
Totals	**158**	**35%**[9]	**56**[10]

Table 16 shows that Manufacturing companies and Hotels/Restaurants, as sub-groups of Terasen's Commercial Energy Assessment Program participants, have the highest incidence of free riders. Overall, it appears that roughly 35% program participants are free riders in that these 56 program participants (out of 158) would have paid for the assessment if it was not free.

OVERALL EFFECTIVENESS OF THE PROGRAM

[8] This number should not be considered reliable because of the sample size of one (1) interviewee.
[9] Excluding Apartments/Stratas
[10] Excluding Apartments/Stratas

The best measure of overall effectiveness for this program is whether or not the program convinced customers to reduce their consumption.

It is clear from previous sections in this report that a significant number of program participants did reduce their natural gas consumption as a direct result of this program. The findings show that 68% of program participants who implemented the recommended changes saw a distinct decrease in their natural gas consumption not attributable to other factors. However, 32% of program participants who implemented changes saw their consumption rise, instead of fall, even after factoring in reduced demand due to production decreases or operations changes.

When we also look at respondent premises where recommended changes were not implemented (29 premises), we see that 44% of these non-compliant program participants managed to decrease their consumption. From this perspective, **the program could be considered effective in getting certain types of customers to reduce their consumption** – the details of which will be outlined in the Analysis section of this report.

As mentioned in the Executive Summary, only 43% of respondent premises actually implemented any of the gas saving measures recommended by the energy assessment report. This is an increase from the 2005-2007 program review where only 35% of respondents implemented the recommended changes.

As you can see from Table 17, the program overall is performing well but the entire weight of that performance is being carried by one category of customers – manufacturing companies. Without this category's participation in the program, the program could not be considered a success.

Table 17: Summary of Energy Savings

	Program Participant Premises	**Total GJs Saved**	**Average Savings Per Premises**	**%Premises that made recommended changes**	**% Premises that made recommended changes but did not see a decrease in consumption**	**% of Premises that did not make recommended changes but saw a decrease in consumption**
Apartments/Stratas	26	3,064.6	2.60%			
Care Homes	12	3,634.1	2.10%	50%	25%	0%
Hotels /Restaurants	15	1,089.1	0.68%	50%	0%	0%
Large Public Facilities	47	9,901.1	2.19%	44%	22%	33%
Manufacturing	**36**	**231,303.9**	**5%**	**54%**	**8%**	**23%**
Offices	16	755.5	0.84%	0%	0%	43%
Total	**152**[11]	**249,748.3**	**2.63%**	**43%**	**13%**	**24%**

Overall, the Commercial Energy Assessment Program was successful with the participation of Manufacturing companies. Taken alone, the manufacturing customers that participated in this program carried the weight of the program. If they were not involved, the program would not have been able to make any claims of success.

ANALYSIS

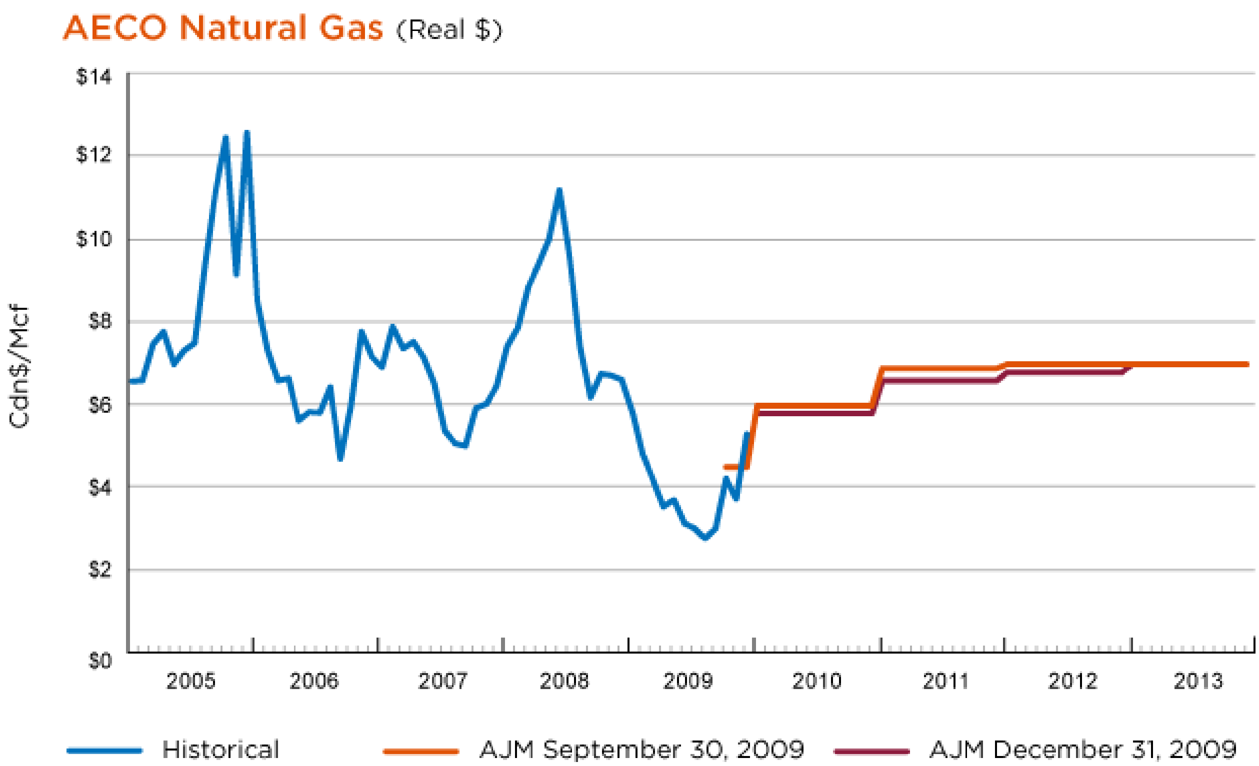
[11] Npte: This total excludes "warehousing" and "other" respondents. There was insufficient data to analyze these business types.

This section of the report goes into more depth where there are interesting or puzzling findings. Analysis is done in the context of Terasen Gas' operational realities – the Commercial Energy Assessment Program needs to achieve the outcomes it is designed to achieve.

OTHER FACTORS CONTRIBUTING TO CONSUMPTION DECREASES

Figure 12 (below) shows the historical market price of natural gas (per thousand cubic feet – roughly 1 GJ) between January, 2005 and December, 2009 with estimations on prices out to 2013. Notice that the market price of gas drops in conjunction with general Canadian commodity prices during the same time period (see Figure 13 – next page).

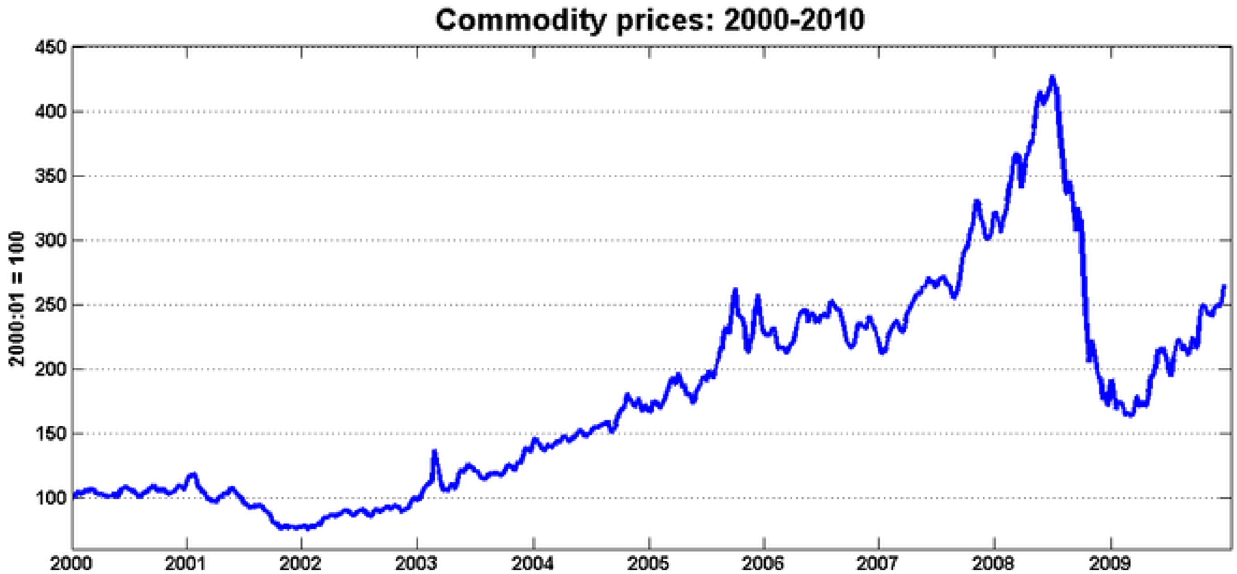
Figure 12: Market Price for Natural Gas ($CAD), 2005 – 2013 (estimated)[12]



In practical terms, this means that for the second half of this study period, the declining price of natural gas would not have motivated program participants to reduce their consumption. For this reason, this paper concludes that the price of gas was not a contributing factor to the findings.

[12] Source: AJM Petroleum Consultants

Figure 13: Canadian Commodity Prices[13]



45% of program participants who did not implement gas-saving measures suggested by Terasen Gas consultants still reduced their consumption after their audit. This number is calculated after factoring in staffing changes, changes in hours of operation or production increases and decreases at the customers' location post-assessment. As mentioned earlier, we attribute this change to the introduction of a "conservation culture" to the program participants (Darby, 2001) and expect to see a 10% average reduction in consumption as a result. The actual reduction seen in this study due to "conservation culture" was a modest 1.4%.

The economy certainly has a role to play in customers' price sensitivity regarding natural gas but as was mentioned in a previous section, this study saw almost equal numbers of companies who claimed to be negatively impacted by the economy see their production go up and down.

In conclusion, it appears that all of these external factors appear to have no bearing on the consumption behavior of program participants. Economic incentives and heating degree days appear to be the dominant drivers of reduced consumption.

THE DECISION TO IMPLEMENT RECOMMENDED CHANGES OR NOT

The decision to implement recommended changes is more complex during this study period than it was during the 2005-2007 program review. The economic downturn of 2008 and 2009 forced many businesses to make drastic changes to their operations to stay in business. This includes putting off capital infrastructure investments for years when the finances of these customers are in better shape.

Some companies chose this time period to do upgrades – possibly to leverage tax write-offs that could reduce their overall tax burdens.

At a high level, it is most likely that the decision to implement or not is based on how the expected return on investment timescale for the recommended changes. For example, three of the four companies that saw the largest

[13] Source: Bank of Canada

reduction in gas consumption are customers that use between $68,000 and $3.3 million worth of natural gas per year (compared to the study period median of $28,000 worth of gas per year).

The higher the annual gas consumption of a program participant, the quicker they will realize positive ROI for their capital upgrades – making them more likely to make the recommended changes than those companies with relatively low annual gas consumption.

In the case of most manufacturing companies where the owner of the company is also the major shareholder, it is easier to justify large capital expenditures as long as the net present value (NPV[14]) is high over the short-term for the company. The levels of approvals that a new equipment requisition must go through at most manufacturing companies are much fewer than they are for a Large Public Facility.

In conclusion, it seems clear that manufacturing companies consuming closer to $100,000 worth of gas per year have the motivation and the ability to make the changes recommended by Terasen Gas through the Commercial Energy Assessment Program more easily than other types of businesses.

ENERGY SAVINGS

Unlike the 2005-2007 program review, researchers for this study had access to much better quality data. Historical billing records from Terasen were accurate, complete and paired with regional HDD statistics matched to the billing period. Researchers also had the results of the previous study for comparison as well as the additional justification for bringing in GJs saved when no recommended changes were made (Darby, 2001).

While still not statistically valid, the findings are defendable and in keeping with Terasen's own methodologies for calculating energy savings. In conclusion, it is clear that the program led to gas savings for customers who participated in the program.

OVERALL EFFECTIVENESS OF THE PROGRAM

Clearly, this program was most effective amongst manufacturing companies. These respondents were responsible for 92% of the total GJs reduced in this study while representing only 23% of the total program participant premises.. In conclusion, these findings clearly indicate that the program was most effective amongst manufacturing clients

[14] Net present value is the standard method for using the time value of money to appraise long-term projects. Used for capital budgeting, and widely throughout economics, it measures the excess or shortfall of cash flows, in present value terms, once financing charges are met.

CONCLUSIONS

The conclusions of this study are straightforward:

- 43% of program participants made some or all of the recommended changes.
- It is estimated that nearly 250,000 GJs of natural gas was saved as a direct result of Energy Assessments conducted during the study period
- Manufacturing companies outperformed every other business type in terms of making recommended changes and seeing a substantial decrease in consumption.
- 45% of respondents who did not make recommended changes also saw a decrease in their consumption after the audit.
- The study has determined that roughly approximately 35% of program participants are "free riders" – defined as customers who would have paid for a Commercial Energy Assessment if it was not free.

This leads to the overall conclusion that the program has been a success to date but that it needs to focus on customer segments with the best reduction outcomes. The next section contains recommendations for changes to the program.

RECOMMENDATIONS

It is clear from the findings that the manufacturing industry has the highest potential to generate positive outcomes for the Commercial Energy Assessment program. The manufacturing industry has lower levels of bureaucracy that facilitate quick decisions on capital expenditures that make a large impact. Ensuring that recommendations result in short ROI for program participants is key when marketing this program and reporting on its effectiveness.

The conclusions from this study indicate that since a diversified portfolio of demand-side management programs available to commercial and light industrial customers is not a realistic policy option, the minimum requirements for participating in the program need to be reviewed.

Our recommendation is to move the minimum consumption rate to qualify for participation in the program to $75,000 per year in gas or more. For example, if this program had excluded customers with less consumption from the current study set (mid-2007 to mid-2009):

- **The average GJs of gas consumption reduced per month per program participant would grow from 142 to 711**
- **52% of Manufacturing companies in the study period would still be eligible**

This is not to suggest that companies with less than $75,000 in natural gas consumption per year would no longer receive assessments under any circumstances – just that they would need to be pre-qualified before participating to ensure that they are the type of customers that is more likely to invest in infrastructure upgrades to reduce gas consumption.

The recommended improvements to the Commercial Energy Assessment Program are as follows:

1. **Move the minimum amount of gas purchased to participate in the program to $75,000 per year.**
2. **For customers spending less than $75,000 per year on gas, develop public workshops that teach basic consumption reduction techniques.**

The following page details two specific DSM Program delivery vehicles that Terasen could consider developing to improve the overall effectiveness of the program. The expected outcomes of implementing these recommendations are:

1. **Vastly improved cost-effectiveness of program**
2. **Bigger reach into the customer base with less effort**

RAISE THE MINIMUM REQUIREMENTS FOR PROGRAM PARTICIPATION

The findings of this study show that the Commercial Energy Assessment program (as delivered between mid-2007 and mid-2009) was most effective amongst customers in the manufacturing (light industrial) sector. These clients tend to spend much more than the median gas spend and will experience significant position ROI in a short span of time.

In most cases, the companies with the most flexibility to reduce their consumption are those with larger utility bills in the first place. While Terasen cannot exclude participants from the program, raising the program requirements may reduce the amount of companies that report a negative outcomes after their assessment.

SECTOR-SPECIFIC WORKSHOPS

Once the Commercial Energy Assessment program admission requirements are adjusted, a new program for those customers who are least likely to implement recommended changes from the Commercial Energy Assessment can be built. Public workshops might be the best solution. These workshops would target specific customer groups such as apartment building managers, care home operations managers and property managers.

The cost of one workshop would exceed the cost of a single audit but could reach dozens of customers in that sector. For the same expenditure, a public workshop campaign could expand the reach of the Demand Side Management program. The 2005-2007 program review saw support for this recommendation amongst the study respondents – 81% of respondents said that they would be interested in “educational seminars to learn more ways to reduce gas consumption”.

The content of these workshops should focus on informing customers what a normal gas consumption profile looks like, the many reasons why a customer’s gas consumption might be above average and a number of pointers on how to reduce consumption. Customers that are very keen to do everything they can to reduce their consumption could apply for a Commercial Energy Assessment of their own. For most customers, this would not be necessary.

APPENDIX A: INTERVIEW SCRIPT

Terasen Gas Commercial Energy Assessment Interview Script

Friuch ID (number from first column of calling list)		Interviewee Name	
Interviewer (Sean or Aaron)		Company Name	
Date		Phone Number	

"We are calling on behalf of Terasen Gas. We wanted to follow up on the audit that was conducted on Date. Terasen is interested in helping their customers to reduce gas consumption and your feedback will help us to determine the effectiveness of our Commercial Energy Assessment program."

1. What was your opinion of the audit that was done on <insert date on file for their Energy Assessment>?

2. Did you receive a copy of your Energy Assessment after it was completed?

3. Are you still in the same building as you were when the energy assessment was conducted? **(If no, full stop interview and track those who have moved but do not count them towards the final count)**

4. Did your company implement any of the changes recommended in the audit?

    a. If yes, which changes were implemented and when?

    b. If no, why did your company decide not to make any of the recommended changes?

5. <if changes were implemented> Did you do an analysis of your energy savings after you implemented recommended changes?

    a. If yes, were the results what you expected?

    b. If no, did you notice an overall decrease in your Terasen Gas bill?

6. <if changes were implemented> Are you satisfied thus far with the changes made?

    a. If not, why?

7. Can you describe the process your organization must go through before making a major capital equipment purchase? i.e. if there is a need to upgrade to a new boiler, what is the process?

    a. How many people are involved in this decision-making process?

8. Was there any follow-up from Terasen Gas staff following your Energy Assessment?

    a. If no, would you like someone from Terasen Gas to follow up with you?

9. What does your company use natural gas for?

    a. Space heating?

    b. Vehicle Fuel?

    c. Water heating?

    d. Electricity co-generation?

    e. Process Heating?

    f. Other?

10. Did your company's production increase/decrease after your energy assessment? E.g. Did you ramp up production? Did you expand your operation? By what percentage? What date did these changes take place?

11. Was your organization/company impacted by the economic downturn of the past few years? i.e. Were work hours at your company reduced? By what percentage? What date did these changes take place?

12. Did your company change owners since the energy assessment?

13. Have you done any major equipment upgrades since the energy assessment?

14. Did you make any structural changes to your facility since the energy assessment?

    a. Have you increased the floor space (for example) of your company since the energy assessment was conducted?

15. During the past five years, has your company conducted any assessments of other areas of the business with an eye to find ways to save money and/or increase return on investment? E.g. Waste reduction programs, electricity audits, lean production analysis?

    a. If yes, were these studies internally funded or did your company leverage government programs?

16. Thinking about how much a commercial energy assessment like the one Terasen conducted for your company should cost if you had to pay for it, please answer the following questions:

    a. At what price would a commercial energy assessment be so expensive that you would not consider doing it? (too expensive)

b. At what price would a commercial energy assessment be so low that you would feel like the quality of audit is questionable? (too cheap)

c. At what price would a commercial energy assessment start to look expensive but not out of the question, but you would have to think hard before scheduling the audit? (expensive/high side)

d. At what price would a commercial energy assessment be a bargain – a great buy for the money? (cheap/good value)

17. If Terasen Gas no longer provided free Commercial Energy Assessments to businesses like yours, would you pay a third party (such as a heating/ventilation/air conditioning engineering consultant) to do these audits for you if you had to pay its full value of $1,500?

    a. Yes

    b. No, if not why not?

18. How many employees does your company have at the moment?

    a. Has the number increased or decreased since the Energy Assessment?

    b. Have you changed your hours of operation since the Energy Assessment?

Finally, we'd like to let you know that Terasen is launching a new program aimed at high efficiency commercial hot water heaters.